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# ANNALS of SURGERY

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Edited by

LEWIS STEPHEN PILCHER, M.D., LL.D.

of New York

With the Collaboration of

SIR WILLIAM MACEWEN, M.D., LL.D.

of Glasgow

W. H. CLAYTON GREENE, F.R.C.S.

of London

THE EFFICIENT TREATMENT OF ACUTE AND CHRONIC, SIMPLE, TRAUMATIC SYNOVITIS (HÆMARTHROSIS AND HYDARTHROSIS) BY REPEATED ASPIRATIONS AND IMMEDIATE, ACTIVE MOBILIZATIONS WITHOUT SPLINTING.....	677
CLARENCE A. McWILLIAMS, M.D.....	NEW YORK
A METASTASIZING MALIGNANT TUMOR OF THE THYROID GLAND.....	684
FRANK L. MELENEY, M.D.....	PEKING, CHINA
SUPPURATIVE OSTEOMYELITIS DUE TO THE COLON BACILLUS.....	695
NATHAN WINSLOW, M.D.....	BALTIMORE
CHRONIC EMPYEMA IN U. S. A. ....	700
WILLIAM L. KELLER, M.D.....	WASHINGTON, D. C.
CHRONIC CATARRHAL CHOLECYSTITIS WITH LIPOID DEPOSIT.....	736
JOHN R. CONKERY, M.D.....	SPOKANE, WASH.
ASEPTIC RESECTION OF INTESTINE.....	739
FOSTER K. COLLINS, M.D.....	LOS ANGELES
ASEPTIC TECHNIC FOR THE RESECTION OF INTESTINE.....	745
CYRUS F. HORINE, M.D.....	BALTIMORE
INVOLVEMENT OF THE LYMPH-NODES IN CARCINOMA OF THE RECTUM.....	755
JAMES ROBERT McVAY, M.D.....	ROCHESTER, MINN.
SOLID CARCINOMA OF THE OVARY.....	768
MERLE R. HOON, M.D.....	ROCHESTER, MINN.
DOUBLE LIP.....	776
GEORGE M. DORRANCE, M.D.....	PHILADELPHIA
SUBMAXILLARY SALIVARY CALCULUS.....	778
E. FRANKLIN BUZBY, M.D.....	PHILADELPHIA
TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.....	782
STATED MEETING HELD MARCH 22, 1922	
CORRESPONDENCE.....	799
INDEX.....	805

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# ANNALS *of* SURGERY

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## THE EFFICIENT TREATMENT OF ACUTE AND CHRONIC, SIMPLE, TRAUMATIC SYNOVITIS (HÆMARTHROSES AND HYDARTHROSES) BY REPEATED ASPIRATIONS AND IMMEDIATE, ACTIVE MOBILIZATIONS WITHOUT SPLINTING\*

BY CLARENCE A. McWILLIAMS, M.D.  
OF NEW YORK, N. Y.

THE treatment of purulent infections of the knee by incision without drainage tubes, and immediate, active mobilizations, as advocated by Willems, has gradually and slowly displaced all other methods. This has only been accomplished by demonstration of the superb results obtained by this treatment in the numerous cases, met with in the late war, of severe infections of the knee-joint. The last word seems to have been spoken regarding the efficient treatment of infected knee-joints and we may consider the proper method of handling these severe lesions as definitely settled. This marks a great advance.

In civil life infected knee-joints are comparatively rare, in contradistinction to traumatic, simple effusions, which are very common, and which are badly treated in general, resulting in needlessly prolonged convalescences with subsequent disability and weakness. Most authorities still assert the necessity for immobilization with splints until the fluid disappears. Practically all the authorities which have appeared during the past two years have been consulted, and all but two insist upon the necessity of immobilization, while only two assert the advisability of evacuation of the fluid by aspiration. Thus, we find the following views: In 1907, Lovett expresses his idea of the proper treatment of acute, traumatic synovitis in *Keen's Surgery*, vol. ii, p. 300, and this plan of treatment remains with the majority of surgeons to-day the usual one, stereotyped as it were from one text-book to the other. Lovett says, regarding the treatment of acute synovitis, that "the most effective means at our disposal is rest to the knee-joint by the use of a splint made of wood, tin, or plaster-of-Paris. Fixation is continued until the fluid begins to subside, when measures to stimulate the local circulation are indicated. Massage, beginning in periods of fifteen minutes, given once or twice daily, is started as soon as the heat and extreme tenderness have disappeared, and continued until the synovial membrane is practically normal. If it irritates, it should be

\* Read before the New York Surgical Society, October 11, 1922.

stopped. Hot-air baking is useful from the outset, and should be given from thirty to forty-five minutes once a day. Douching, sponging, or packing with hot water are useful from the beginning, and, when the effusion has subsided, are more effective if followed by a cold douche. Compression to the joint when possible is obtained by a flannel bandage firmly and evenly applied over the splint. At first the splint should be removed only for the local treatment mentioned, and immediately re-applied. When the effusion has disappeared, restricted, but gradually increasing use should be allowed the protected joint. Unrestricted use is permissible only after the synovial membrane has become apparently normal, and use of the joint is not accompanied or followed by any serious amount of pain. Fixation must be continued long enough to quiet the inflammation of the joint, but not after that, for in the latter case muscular atrophy and a weak and irritable joint are favored." He also says that simple, chronic synovitis, which is merely the outcome of the acute condition, should be treated temporarily by fixation and compression, if symptoms of irritability are present, in order to regulate the circulation and diminish the effusion. Following this should come treatment by stimulating measures, which should be instituted as soon as effusion and irritability have diminished. These consist of massage, hot-air douches, and increasing and restricted use, as described in speaking of convalescence from acute traumatic synovitis.

It will thus be seen that the master word in this scheme of treatment is immobilization with various exhausting, physiotherapeutical, secondary accessories, all of which are unnecessary with the proper and efficient measures of treatment. There is no mention made of the necessity of aspirating the joint of the fluid. One would gather that the pain in the joint, on movement, is due to the lesion producing the fluid in the joint rather than to the passive presence of the fluid itself, as is actually the case.

This method, described by Lovett, was the generally accepted plan of treatment up to the time of the War. Let us examine various authors, who have written on the subject since 1919, to see whether the War taught anything in the treatment of these common lesions.

Albee, *Reconstructive Surgery*, 1919, p. 501, says that acute synovitis, the result of trauma, should be treated by rest of the parts, by elevation on a posterior splint and the application of an ice-bag. Nothing is said about the primary necessity for aspiration, except that "Aspiration may be practised if there is great discomfort from the tension." Of course it follows that if aspiration be not performed, immobilization is necessary because of the pain of the effusion. Remove the fluid and the movements of the joint are not only possible because almost painless, but very advantageous in promoting perfect future function. To my mind, even small amounts of fluid should be removed at the very outset of treatment.

Whitman, *Orthopaedic Surgery*, 1919, p. 414, says that the patella floats when 30 c.c. of fluid are contained in the joint, the normal capacity being about 200 c.c. "Injury and its attendant synovitis may be treated, immediately, by splints, by elevation of the limb, and by the application of ice-bags. After the acute symptoms have subsided, the absorption of the effused fluid is aided by functional use of the limb, if the joint is properly protected by adhesive strapping. Aspiration



## TREATMENT OF TRAUMATIC SYNOVITIS

is always indicated if the tension of the effused fluid causes discomfort." Here Whitman evidently considers aspiration as a secondary and late, and, as it were, last resort method of treatment.

Mennell says in the *System of Orthopædic Surgery of Injuries*, Jones, 1921, vol. ii, p. 540, that it is fatal to keep a case of simple synovitis of the knee at rest on a splint in bed till all the fluid has subsided, and then allow the patient to walk. Treatment by massage and mobilization should begin immediately after injury. A patient who twists his knee may be done up in a compression bandage and pad or in strapping and be allowed to walk forthwith. Mennell does not mention aspiration of the joint. How can a patient with a joint full of fluid, as the result of trauma, bend his knee? The mechanism of the joint will not allow it until the fluid is absorbed, which is a long, slow, tedious process.

Stillman, *Treatise on Regional Surgery*, Binnie, vol. iii, 1921, p. 490, says: "Locally, in the milder cases (serous or serofibrinous synovitis), complete immobilization by a plaster-of-Paris spica should be secured. When there is considerable exudate present, aspiration is often beneficial. It relieves the pain and removes the pressure on the inflamed capsule. Extension by weight, to keep the articular surfaces from pressing against one another, is desirable, but the weight should not be too heavy, else the inflamed and softened capsule and ligaments may be stretched. Fixation is continued until the signs of acute inflammation have subsided. When local heat and tenderness have subsided and the exudate begins to be absorbed, massage, compression by elastic bandage, and careful passive motion will hasten absorption. When the effusion has disappeared, restricted but gradually increasing use of the protected joint is permitted; but only after the synovia has apparently returned to its normal condition, and the use of the joint is not accompanied nor followed by any serious degree of pain, is unrestricted motion allowed. Prolonged fixation favors muscular atrophy, and renders the joint weak and irritable. If there is any doubt concerning the character of the exudate, an exploring needle should be used. If a purulent exudate is present, free incision, irrigation of the joint with normal saline, and the establishment of thorough drainage are essential." Regarding chronic serous synovitis (hydrops), he also says (p. 498): "If it is the result of acute synovitis, and pain and tenderness persist, traction and fixation are indicated. Compression by bandage, mild degree of counter-irritation and massage will hasten absorption of the exudate. In cases not influenced by these procedures, operation is indicated."

Moorhead, *Traumatic Surgery*, 1921, p. 166, says, regarding the treatment of acute synovitis, that: "1. rest; 2. immobilization; 3. function, are necessary. The joint (knee) should be put at rest with an ice-bag applied over it. It takes one to five days for the effusion, to reach its maximum, during which time pressure by a splint should be applied, tightening the outside bandage each day. When pain on pressure subsides (usually in two weeks) massage should be instituted. A week later walking may be allowed with adhesive plaster strapping. It is rarely necessary to aspirate the fluid in the joint. In chronic synovitis the fluid can be removed by any of the means suggested in the acute form until it is demonstrated that these pressure and rest objects are unattainable except by more drastic measures. Aspiration under perfect asepsis is then advised. To restore muscular tone and strengthen relaxed and shrunken soft parts, we employ massage, vibration and electricity and some motions that will not too severely tax the joint."

He finally ends by saying, "I have recently treated several acute cases by immediate aspiration, requiring the patient to actively move the joint after all the fluid has been withdrawn. Re-effusion is treated by re-aspiration. This procedure has very materially shortened the disability."

Billington, *Jour. Amer. Med. Assoc.*, 1922, Oct. 7, p. 1207, regarding the

treatment of acute, subacute and chronic traumatic synovitis, makes no mention of aspiration but applies a plaster-of-Paris splint, according to old orthodox lines of treatment.

Fay, *Surgical Diagnosis and Treatment*, 1922, Ochsner, vol. iv, p. 710, says: "Traumatic synovitis is at once the commonest and the most benign lesion of the knee resulting from injury, and under this term we may classify all effusions into the knee in which injury to the ligaments, the semilunar cartilage and the patella can be excluded. The stability of the joint is not affected unless very extensive effusion has resulted in temporary stretching of the ligaments, but there may be considerable pain and tenderness. The condition should be treated immediately by rest and cold applications, and, as soon as pain and tenderness have subsided, judicious exercise should be urged to aid in dispelling the effusion. In the occasional case in which the condition becomes chronic, elastic pressure and moderate use of the joint will usually effect a cure."

The *Oxford Index of Therapeutics*, 1921, p. 865, advises tight strapping, which immediately arrests the effusion and brings about absorption, at the same time prevents stretching of the ligaments; he advocates *passive* movements within twenty-four hours and *active* movements in two or three days. No mention is made of aspiration of the fluid. How one is to make passive movements in a joint distended with fluid is not mentioned. Movements of a distended joint decrease its capacity, and, as the fluid is non-compressible, movements to any extent are not only very painful but are impossible as long as the joint contains fluid.

H. S. Taylor says: "A simple synovitis should recover in three to six weeks." Under the treatment by repeated aspirations and active mobilizations, such a case should be well in from ten days to three weeks.

Cotton, *Surg. Clin. North America*, August, 1922, 1023, in an exhaustive article on knee lesions, makes no mention of aspiration. He says: "The ordinary synovitis cases ('water on the knee,' resulting from almost any blow or twist or strain), treated by plaster-of-Paris or splints, shows a very early *selective* degeneration and atrophy of the rectus portion of the quadriceps muscle. Such atrophy promptly leads to a lax joint and perpetuation of the synovitis (better and then anon occurring) for several months under the usual routine (*i.e.*, splinting). Under adequate but trained (and restrained) massage of joint and muscle, the fluid goes, the muscle does not dwindle and one saves several weeks at least. There is no reason why a synovitis case cannot go about without crutches, but they should use a stout cane. Synovitis cases should be—though often they are not—well after about six weeks." Cotton uses straps, bandage, massage and supervised exercises. The author would suggest that were immediate aspirations of the fluid added to Doctor Cotton's procedures, the duration of the disability would be cut at least one-half, in which case also the other physiotherapeutic measures would be unnecessary, an important point in the management of hospital patients.

Mobilization was the idea of Lucas-Championnière forty years ago, and we have been gradually coming more and more to its adoption, but aspiration of the fluid was foreign to his conception. Then John B. Murphy advocated repeated aspirations, to be followed afterwards by absolute immobilization with traction. Now it would seem that with all our war experience behind us aspiration *without* mobilization is incorrect. The most efficient method of treatment appears to be the combination of repeated aspirations with immediate mobilizations (walking and *active* movements) without splinting. It took the genius of Willems to combine these two methods, and to him we owe a great debt of gratitude for having given us a most satisfactory, rapid, and

## TREATMENT OF TRAUMATIC SYNOVITIS

efficient method of treating these obstinate lesions. Willems says (*Surg., Gyn. and Obstet.*, 1919, June, p. 546): "It is now some years since my attention was directed to this problem (traumatic joint effusions), and I have freed myself by degrees from practicing the law of immobilization. I have commenced with evacuatory punctures to drain traumatic effusions of the knee, hæmarthroses and hydarthroses, and by making the patient walk immediately. Not only could they do this without any difficulty, but their lesions cured in a few days without leaving any trace. My method of treating traumatic effusions by puncture, followed by immediate movements, was rapidly adopted by practitioners, dealing with industrial accidents, owing to the great rapidity and perfection of the recovery and also owing to its great simplicity." Willems and Murphy are the only two authors who maintain, as the primary requisite of proper treatment, aspiration of the joint.

The increased secretion of synovial fluid is the result of nature's attempt to float apart the two inflamed surfaces. Distention produces stretching of the ligaments with subsequent weakness of them. Pain caused by attempts at moving a distended joint, together with decreased circulation, consequent upon pressure, due to the fluid, produce quickly flabbiness, weakness and even atrophy of the muscles. Synovial fluid is more slowly absorbed than it is secreted, but, when the fluid portion is absorbed, a gelatinous residue is left which coagulates. This coagulum may organize, producing adhesions with its consequent partial or complete ankylosis. In addition, small particles may be broken off the coagulum and become loose in the joint, producing the so-called "rice-kernels." Hence the effusion should be removed at the earliest possible moment after the injury so as to prevent the formation of this coagulum, and the joint should be kept free from fluid by repeated aspirations subsequently, even as often as every second or third day.

The pain attendant upon any movement of an acutely distended joint is agonizing. It is surprising how immediate is the disappearance of pain after aspiration of the fluid. As the fluid subsequently reaccumulates, pain returns, to be immediately relieved by subsequent aspirations. This gives the key to the treatment. The aspirations should be repeated as often as the fluid reappears. Combined with the aspirations should be active, but not passive, motions of the joint with walking begun immediately after the aspiration. If there be a sprain of the joint, strapping may be applied so as not to restrict the motions too much. If there be lateral mobility, a hinged lateral brace should be fitted which prevents twisting and lateral strain but allows normal flexion and extension of the joint. The motions are only active because with these, pain will prevent their being carried so far as to produce additional lesions; passive motions, on the other hand, are blind, and therefore are not permissible because of the danger of their being performed too vigorously, thereby increasing the effusion of blood and synovial fluid because of the additional lesions caused thereby.

The simplicity of the after-treatment is its great advantage, together with the rapidity of the convalescence. There need be no artificial massage,

bakings, passive motions, nor any other physiotherapeutical means, save possibly an ice-bag, since the active motions produced all the effects artificial massage accomplishes. Aspiration of the knee is as simple and innocuous as aspiration of the chest. Tincture of iodine and a sterile aspirating needle are all that are necessary. The needle is inserted, without touching its point with the fingers, one inch to the inner side of the patella just above its lower border. It is inserted outwards and upwards and its point comes to lie behind the patella and between the tibia and fibula. If aspiration be done soon after the injury, the effused blood will not be too thick to be aspirated through a fair-sized needle. Hence aspiration should not be the last resort, but the first to be done, since it may be impossible to draw off the coagulum which later results. There need not be the slightest fear of infecting the joint if ordinary aseptic precautions be adopted. One does not hesitate to aspirate a chest through fear of infection and the same should be true of the knee-joint.

With repeated aspirations and active movements of walking, a patient with an acute, traumatic synovitis should be well in from ten days to three weeks, with a painless, perfectly functioning joint, instead of the usual time of from three to six weeks, with a weak, tender joint with the liability to a recurrence of the fluid. The idea of the necessity of immobilization in traumatic synovitis seems to have so firmly imbedded itself in the surgical consciousness that dislodgement of it would seem almost impossible. The first thing necessary is for authorities who write text-books to cease advocating this obsolete method, then gradually the practitioner will take up the better procedure. Stress should be laid on the preliminary necessity of aspiration of the fluid from the joint in order that pain may be lessened and immediate mobilization may be rendered possible, following which aspirations should be repeated as often as necessary to keep the joint free from fluid.

The following patient illustrates the acute condition. A well-to-do man of forty-five years of age was playing tennis in the country, on April 16, 1922, when suddenly he twisted his right knee and fell. He managed to get to a neighboring house and came to town, when he was seen by the author late that night. His temperature was  $101^{\circ}$ , and the right knee was very painful on motion, containing a slight effusion. There was no dislocation present nor any abnormality in the position of the bones of the joint, nor could any joint mouse be felt. There had never been any previous trouble with the knee. A tentative diagnosis was made of a sprain of the knee. The joint was strapped and an ice-cap applied over the strapping. The next morning the joint was tense with effusion, and it was aspirated, six tablespoonfuls of fluid blood, mixed with synovial fluid, being obtained. Any motion in the joint, prior to the aspiration, was impossible because of the exquisite pain caused thereby, but, after the aspiration, active flexion could be made to the extent of  $25^{\circ}$  without much pain. He was instructed to make active flexion every two hours, in bed, to the greatest extent possible. The temperature for one week ran  $101^{\circ}$  in the afternoons, due probably to the effused blood. On the third day he was allowed up and was given crutches and told to put weight on the knee, and to flex it as much as possible without causing pain. On the fourth day, the fluid had re-accumulated, so another aspiration was performed, obtaining four tablespoonfuls of less thick blood and synovial fluid. On the seventh day, he



## TREATMENT OF TRAUMATIC SYNOVITIS

walked without crutches. Subsequent aspirations were done on the tenth, fourteenth and eighteenth days. All except the last aspiration were bloody in gradually decreasing amounts and quantity. At the last aspiration, only one tablespoon of clear synovial fluid was obtained, and he was walking as usual without support, having been at his business since the seventh day. He was well on the twenty-first day. Six weeks later he wrote that he was riding horse-back, walking and swimming without discomfort or weakness. One great advantage of aspiration is the ability it provides of determining whether the joint contains a joint mouse or a dislocated meniscus, since motions are so much freer and carried out with so little pain when the joint is free from fluid, rendering palpation very easy. Other great advantages of this treatment, combining repeated aspirations with active motions, are the simplicity of the after-treatment, the little restraint necessary, the quickness of the cure, as well as the perfect, final, functional result.

### CONCLUSIONS

1. Repeated aspirations combined with active (never passive) motions, and walking without splints afford the best method of treatment of acute and chronic, traumatic, joint synovitis, provided there be no joint mouse nor dislocated meniscus present.
2. Aspiration should be *immediately* performed in all types of traumatic joint effusions as it relieves pain immediately, renders a correct diagnosis more certain, prevents stretching of the ligaments with their consequent weakening, and avoids subsequent muscular atrophy.
3. Such treatment makes unnecessary all other subsequent physiotherapeutic measures, hence its simplicity makes it applicable to all classes of patients.
4. Such a method of treatment produces a more perfect cure in one-half of the time that is required by the old immobilization method.
5. To leave fluid in a knee, the result of trauma, is just as irrational as to leave fluid in a chest unaspirated.
6. Aspiration of a knee is a simpler procedure and less dangerous than aspiration of a chest, and can safely be performed in a doctor's office or a dispensary, and the patient thereafter can be immediately sent home walking.
7. The effects of physiotherapeutical measures have been overestimated, being used empirically and without foundation. They are makeshifts to excuse procrastination in not applying a radical, curative procedure such as aspiration.

## A METASTASIZING MALIGNANT TUMOR OF THE THYROID GLAND

BY FRANK L. MELENEY, M.D.

OF PEKING, CHINA

ASSOCIATE IN SURGERY, PEKING UNION MEDICAL COLLEGE

THE thyroid gland continues to claim the interest of many branches of medicine because of the secrets still hidden in its physiology and pathology. The clinical entities of exophthalmic goitre and toxic adenoma have become fairly well established as a result of the work of Kocher,<sup>8</sup> Plummer,<sup>12</sup> Wilson,<sup>18</sup> and others. Also the histological picture of exophthalmic goitre

is quite definitely understood and quite clearly differentiated from the other pathological conditions, thanks to these observers as well as to MacCallum,<sup>10</sup> W. S. Halsted,<sup>7</sup> and Bloodgood.<sup>2</sup> The microscopic picture of toxic adenoma is less clearly understood because of the difficulty of demonstrating the portions of the tumor giving rise to the toxicity. It may be that further observations will confirm the theory suggested by Goetsch<sup>5</sup> that the physiological or pathological activity of the tumor cells may be made evident by mitochondrial stains. Cysts have been satisfactorily accounted for and described by Bloodgood.<sup>3</sup> Colloid goitre, having received almost universal recognition by reason of its geographical distribution,



FIG. 1.—Photograph of patient after the removal of a gland from the left posterior triangle for diagnosis.

still baffles medical science with regard to its cause and prophylaxis, although Marine and Kimball's<sup>11</sup> work seems to be particularly promising. The histology is quite definite.

The other tumors of the thyroid, however, ranging from the fetal adenomas and simple adenomas to the malignant and metastasizing tumors, are still unsolved clinical and pathologic problems of the greatest interest and importance.

Langhans,<sup>9</sup> in 1907, pointed out that the histological picture of the malignant tumors of the thyroid differed widely from the typical

## METASTASIZING THYROID TUMOR

carcinomas of breast, stomach, lip, etc., and believing that the term carcinoma was not sufficiently clear or definite, made a new classification. He admitted, however, that sometimes the various forms which he described merged into one another and that the classification was difficult at best. Wilson<sup>16</sup> has recently had the opportunity of presenting a large series of cases of malignant tumors of the thyroid. Although he has gone a long

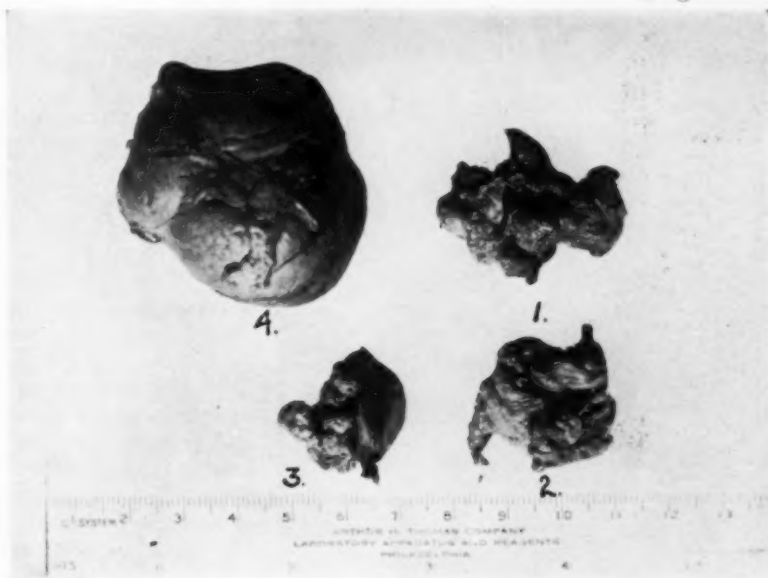


FIG. 2.—Specimens removed at main operation in their relative anatomical positions: (1) from the thyroid gland, (2) from the sternothyroid muscle, (3) from the lower jugular gland, (4) from the main jugular gland.

way in clearing up some of the difficulties, he still admits that the differentiation between the benign and malignant tumors is often clinically impossible and pathologically extremely difficult. He decries the fact that there are not more data available, and has pointed out that there are probably many cases which have never been reported which could materially add to our knowledge of the subject.

It is with this in mind that I would like to present the following case and discuss its features, briefly, in the light of the recent literature regarding thyroid tumors.

**CASE RECORD.**—Hospital No. 1455. Name, Wu Chao Tau. Nationality, Chinese. Sex, male. Age, eighteen, Chinese reckoning (this in Western reckoning would be seventeen, because the Chinese count the year in the womb and call the child one year old on the day that he is born). Admitted January 11, 1922.

**Chief Complaint.**—Mass on right side of neck—duration six years.

**Present Illness.**—**Swelling:** Began six years ago as a small, firm nodule beneath the right sternomastoid muscle—gradual, but continuous growth of this

single mass with the later appearance of one below and one above the original and another in the posterior triangle. During the last two years a gradual development in the same manner of three others on the left side. None noticed in front. *Dyspnœa*: Gradual development during past year and now quite distressing. Slightly worse on lying down. *Cough*: Dry and unproductive during last few months. *Dysphonia*: Gradually developing with cough. *Dysphagia*: None noticed. *Pain*: None. *Fever*: None. *Loss of Weight*: None. *Loss of Strength*: Only

in so far as breathing is difficult. No other functional disturbances. No general nor special sense symptoms.

The personal history, past illnesses and family history may be omitted because they are irrelevant.

January 11, 1922. Admission Note: Boy of eighteen (Chinese reckoning), somewhat undersized. Round face, bright and intelligent, but anxious. Well nourished, sitting up in bed, gasping for breath and pressing with expiration as if there were considerable obstruction to the intake and output of air. He has a dry and brassy cough. Voice is husky. The neck is greatly swollen (Fig. 1). There is a large mass about the middle of the right sternomas-



FIG. 3 (a).—Photomicrograph  $\times 100$  from the left posterior triangle gland, showing lymphoid tissue and vesicle formation.

toid which seems to push that muscle backward, probably flattening out its anterior fibres. It measures about 6 by 6 cm. There are two smaller masses, one above and one below the main mass, and one in the posterior triangle above the clavicle. There are three similar ones on the left side, two in the posterior and one in the anterior triangle. The right lobe of the thyroid seems to be slightly enlarged and several firm nodules are felt along both sides and in front of the trachea which all move upward on deglutition. These central masses are more or less confluent, but the lateral masses are all discrete. The skin moves freely over them. They are not firmly attached to deeper structures. They are elastic and non-tender. The manubrial dulness is widened slightly. Axillæ and inguinal regions negative. Liver and spleen not palpable. Rest of physical examination negative.

*Opinion*.—The gradual growth of the tumor and gradual development of pressure symptoms, the rather extensive distribution of discrete, freely movable glands, with peritracheal involvement and with probably some mediastinal involvement in a boy of this age, seem to point strongly to Hodgkin's disease, although in this land of tuberculosis that must be kept in mind. Other considerations are lymphosarcoma and thyroid tumor, which are not so likely, I think, because of the boy's age and the manner of development of the swellings.



## METASTASIZING THYROID TUMOR

*X-ray Report.*—The shadow of the soft tissues of the neck is very dense and extends down into the upper mediastinum as a dense shadow. Lungs apparently clear.

A gland from the left posterior triangle of the neck was removed for pathological examination under local anæsthesia. Dr. J. P. Webster made this observation in his operative note: The large gland which was sought, lay quite deep. It was found to be very vascular with an abundant blood supply from the under surface. Some of the vessels nearly as large as a straw. It looked very much like thyroid tissue.

With interest now directed to the thyroid, the following notes were added to the local description given above. There is fulness in the midline below the thyroid cartilage, more marked on right than on left. The principal mass on the right side has a slightly expansile pulsation. A strong systolic thrill is felt over the lower and inner border of the right lobe of the thyroid and a loud systolic bruit can be heard especially at this point, but also throughout the entire mass. No thrill nor bruit on the left side. In the suprasternal notch there is a hard, round, smooth mass 2 cm. in diameter. The neck measures 42 cm. at the level of the thyroid cartilage, 40.5 cm. at the base of the neck and 40 cm. midway between. Eyes normal. No fine tremor. Pulse regular, rate 88. Genitals normal, but pubic and axillary hairs absent (this is fairly common at this age with the Chinese).

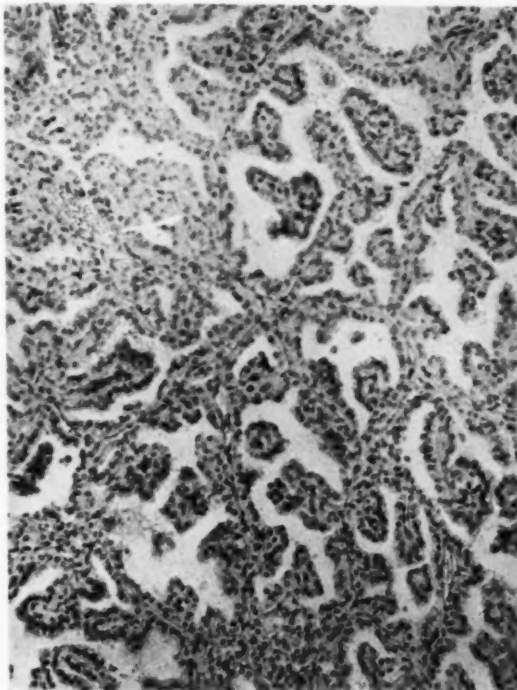


FIG. 3 (b).—Photomicrograph  $\times 100$  from the same gland, showing papillary formation.

Pathological report from excised gland. Metastatic carcinoma of the thyroid (detailed below).

Goetsch test faintly positive. Blood-pressure rose six points after ten minutes and pulse ten points after twenty minutes. Slight subjective throbbing after seven and a half minutes. No other signs nor symptoms.

Basal metabolism test 45 per cent. above normal. Patient not very coöperative—result unreliable. Second basal metabolism test 39 per cent. above normal. Patient more coöperative.

Operation by Professor A. S. Taylor. Partial thyroidectomy and excision of lateral tumor. Great venous trunks were encountered immediately beneath platysma. The main tumor mass lay beneath the middle of the right sternomastoid, which had to be cut. On the tumor surface there were many large thin-walled blood-vessels. The thyroid gland was firm and contained many very hard nodules. It was bound firmly to the trachea. The lower extremity of the

mass could not be reached because it extended into the mediastinum. Extreme hemorrhage was encountered. Considered unjustifiable to attempt complete removal. A wedge-shaped portion of thyroid tissue was removed from the right lobe and a firm nodule removed from the substance of the right sternothyroid muscle. The main mass on the right and a smaller mass below it were removed. During this procedure the large thin-walled vessels bled profusely.

Considerable respiratory difficulty. Temperature up to forty degrees C.

Post-operative pneumonia in left lower lobe. Pneumococcus type IV recovered.

Right lower lobe also involved. Patient very ill.

Gradual and progressive improvement. Small superficial infection in the centre of the wound, cleared up slowly, and finally discharged a silk suture.

Another gland removed from right posterior triangle for mitochondrial stain.

X-ray treatment, Dr. P. C. Hodges. Six three-inch areas marked out over sides and anterior surface of the neck. Each were given eight minutes' exposure through 3 mm. aluminium filter-tube at 10 inches with 5 milliamperes and something over 100 kilovolts.

Patient returned home seventy miles into country.

Follow-up Notes: The patient has not been able to

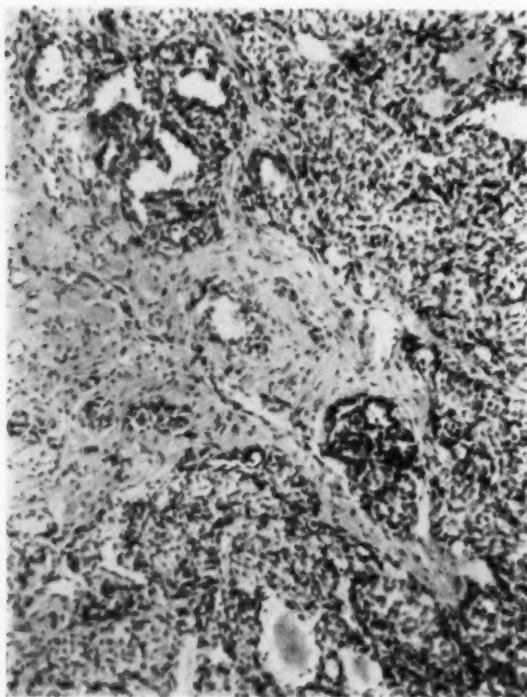


FIG. 4 (a).—Photomicrograph  $\times 100$  from the sternothyroid muscle, showing invasion of the muscle by tumor cells arranged in solid masses and papillary processes.

return for examination. We have indirect news from him to the effect that for a time his health was greatly improved and there was no evidence of growth in the neck. Within the past month, however, five months after operation and X-ray treatment, although his general health is good, the swelling of his neck is increasing.

*Pathological Examination.*—(A) The gland from the left posterior triangle removed for diagnosis.

*Gross Examination.*—Two oval masses, the larger measuring  $3\frac{1}{2} \times 2\frac{1}{2} \times 2$  cm. the smaller  $1 \times \frac{1}{2} \times \frac{1}{2}$  cm. The larger is covered by a capsule which in places is smooth and glistening and in places rough with fibrous tissue attachments. There are many large blood-vessels on the surface. It is firm and elastic. On section the surface is finely granular, pinkish-yellow in color and somewhat spongy. There are a number of small, dark areas. The smaller resembles a simple lymph-gland with a soft, pearly-gray cut surface.

*Microscopic Examination* (Fig. 3).—On one margin there is a semilunar area of lymphoid tissue. This is separated by a thin connective-tissue layer from the

## METASTASIZING THYROID TUMOR

rest of the tissue, which is made up of epithelial cell masses arranged in small lobules and separated from one another by a delicate connective-tissue stroma. The circumference of the section shows a thin connective-tissue capsule with here and there small areas of lymphocytes. The lobules vary in size from 0.1 mm. to 1.0 mm. and are frequently partially confluent. The stroma contains many thin-walled blood-vessels, some of which are distended with blood. The epithelial masses vary greatly in character. In places the cells are in solid spheroidal or polygonal masses without glandular formation. The cells seem to be in a sort of syncytium. The ectoplasm is not distinct. The nuclei are close together and surrounded by a pale staining protoplasm. The nuclei are of a fairly uniform size, perhaps twice as large as normal thyroid cells, but not excessively large. The nuclear outlines are distinct, but the nuclei contain very little chromatin material. Occasionally small, irregular, dark-staining nuclei are seen, but no definite mitotic figures are found after prolonged search. In other places the cells are arranged in small circlets forming tiny vesicles. Many of these are empty, but in some areas many are filled with colloid material. Some also are filled

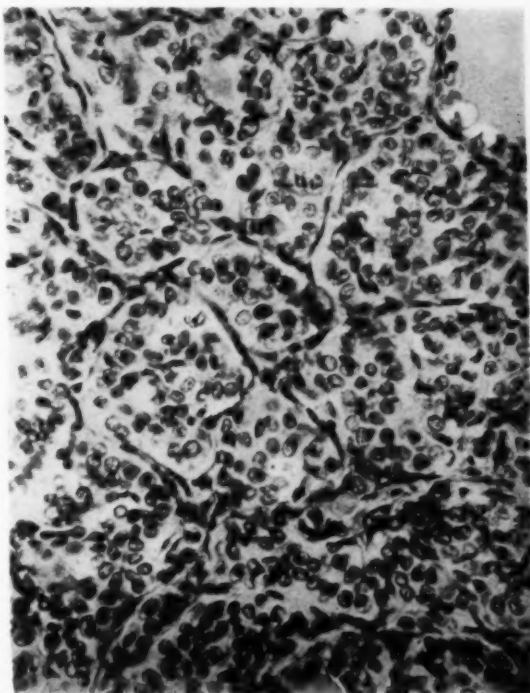


FIG. 4 (b).—Photomicrograph  $\times 260$  from the same tissue, showing cellular detail of the solid portion.

with deposits of calcium, which are usually round, conforming to the shape of the vesicles, but in some places the calcium is irregular in shape and is contained in the surrounding cells. The cells which form the vesicles are quite similar to the cells in the solid masses described above, except that they are perhaps a trifle smaller. The ectoplasm, however, is indistinct and the syncytial appearance is the same. In still other areas there are large spaces filled up with cut branches of papillary processes which are lined either by a single or a double layer of cells. These in general are more columnar, the cell outlines are more definite, the nuclei take a position near the free margin of the cells, and protoplasmic processes reach out into the spaces surrounding the papillae. There is no orderly arrangement of these various forms and nothing to indicate that they are stages of a single development. In some places the solid form, and in others the papillary or acinar forms, are found on the periphery.

(B) The specimens removed at the main operation (Fig. 2).

*Gross Examination.*—The character of the various specimens is identical and all resemble the original specimen described above, except that there is more attached fibrous tissue and here and there are strands of muscle.

*Microscopic Examination.*—1. The section from the substance of the sterno-

thyroid muscle (Fig. 4) shows cells of exactly the same character as those described above. The vesicular formation, however, predominates and most of the vesicles contain colloid. At one side, solid cell masses and cells in papillary formation have invaded the muscle. Some degenerated muscle fibres are seen in among the epithelial cells. Near one border there are streaks of calcium deposit.

2. The section from the right lobe of the thyroid (Fig. 5) shows many normal acini filled with colloid and lined with flattened cuboidal cells and dark-

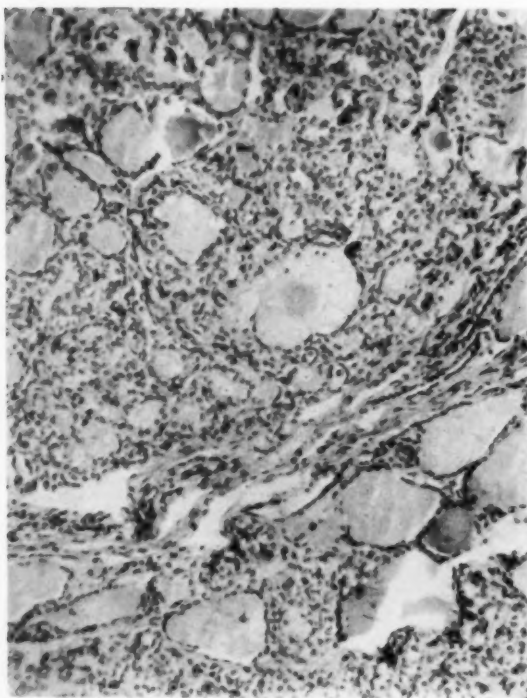


FIG. 5.—Photomicrograph  $\times 100$  from the thyroid itself, showing some relatively normal acini and some masses of tumor cells.

staining nuclei, but the inter-acinar spaces are filled with larger cells of the identical characteristics shown by the cells in the other specimens. In places these cells are grouped in large solid masses. No papillary areas are seen. A few small deposits of calcium are present.

3. The section from the lower jugular gland shows a narrow strip of lymphoid tissue at one side. Elsewhere there is a thin connective-tissue capsule over a mass of tumor tissue. Here the areas are almost entirely papillomatous. There are, however, a few solid masses, a few colloid-containing acini and many small deposits of calcium.

4. The section from the largest mass (Fig. 6) in general shows larger lobules—often 2 mm. in diameter. About half of the tissue is arranged in solid masses and the other half in papillomatous lobules with fine branching and subbranching. The spaces are filled with a pale, pink-staining substance not as dense as colloid. Occasionally blood-cells and pigment granules are seen in these spaces. There are a few colloid-filled acini and many small calcium deposits indiscriminately scattered through the tissue as well as light brown pigment. Around the margin there are remnants of lymphoid tissue. In none of the sections are mitotic figures found. The diagnosis of a malignant tumor is made upon the abnormal type of cell, the abnormal arrangement of the cells and the metastases.

*Diagnosis.*—Carcinoma of the thyroid with metastases in cervical lymph-glands.

(C) Gland removed for mitochondrial stain.

The cells differ somewhat in the number of mitochondria. In general the cells of the solid masses and the cells lining the vesicles have relatively few granules, while the cells of the papillary processes have, perhaps, twice as many. None of the cells, however, are crowded in the manner described by Goetsch<sup>5</sup> for toxic adenomata or exophthalmic goitre.



## METASTASIZING THYROID TUMOR

*Discussion.*—This case is interesting in several respects. The boy was seventeen and the tumor had existed for six years. One hesitates to believe that it arose first in the thyroid and metastasized into the lymph-glands six years ago, but it is even more difficult to believe that it arose in the lateral position, say in an aberrant thyroid, and metastasized into the thyroid and across the midline to the opposite side of the neck. Anatomically, as Shrager<sup>17</sup> has shown, any one of the masses could be an aberrant thyroid, but it seems unlikely that all should show practically the same pathology unless we assume that the same factor of stimulation or irritation acted upon all of them. On the other hand, the presence of lymphoid tissue on the margins of the lateral masses seems to place them definitely as lymph-gland metastases and with the thyroid involved it seems likely that the thyroid was the primary focus. The most likely explanation, therefore, for the whole picture, is a primary tumor of the thyroid arising at or before the age of eleven, metastasizing and growing for six years in the lymph-glands of the neck and mediastinum. It has

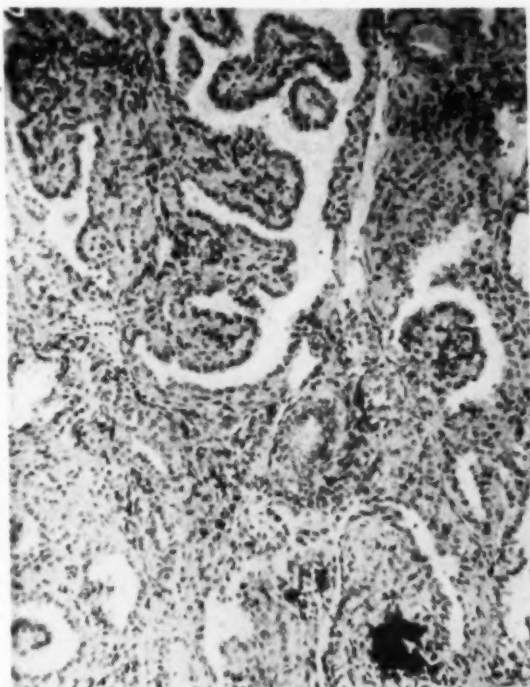


FIG. 6 (a).—Photomicrograph  $\times 100$  from the large jugular gland, showing solid masses, papillary formation and calcium deposit.

frequently been recorded that the metastases of thyroid tumors may greatly exceed the parent tumor in size. In fact, thyroid tumor metastases have been reported in cases in which the thyroid seemed to be perfectly normal, although Bérard and Dunt<sup>1</sup> assert that the primary malignant focus *must* be there. The slow growth in this case is striking, particularly after metastasis had taken place, and is an evidence of relative benignancy. Some pathologists might call it benign, but the weight of opinion seems to be that any tumor which metastasizes is malignant. The absence of mitotic figures and the deposit of calcium are microscopic evidence of slow growth in this case.

How should this case be classified? It corresponds to the proliferating goitre ("wucherende struma") of Langhans<sup>9</sup> in so far as the arrangement of cell masses and small vesicle formation is concerned. On the other hand, the papillomatous element is very prominent and Langhans<sup>9</sup> says that the

papillary form and the "wucherende struma" are very different. Furthermore, there is nothing to indicate that the various forms present are different stages of the same process as Langhans<sup>9</sup> suggests with regard to "wucherende struma," because here the various forms are indiscriminately scattered from the centre to the periphery of the specimens. Neither does it seem to fall into any of the groups into which Wilson<sup>16</sup> has classified the malignant tumors

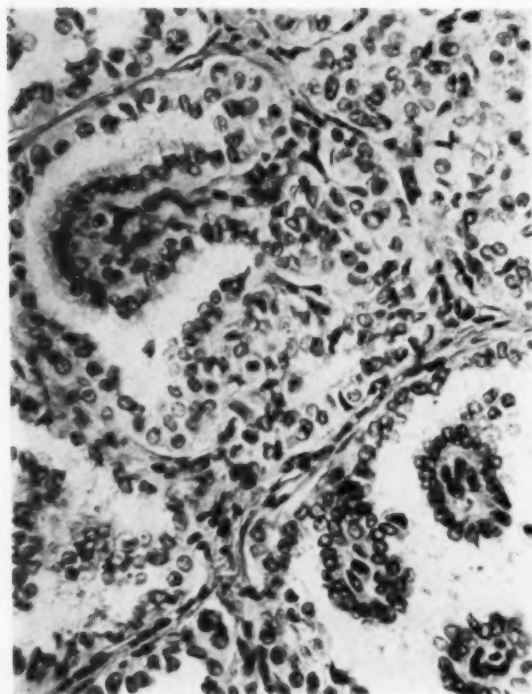


FIG. 6 (b).—Photomicrograph  $\times 260$  from the same gland, showing cellular detail.

of the thyroid. After a study of the literature on malignant thyroid tumors one is puzzled to know what the criteria of malignancy of such tumors are. It would seem that the ordinary criteria of malignancy must be changed somewhat when applied to the thyroid.

I believe that most pathologists would say that the general criteria of malignancy are (1) growth out of bounds, *i.e.*, either invasion of neighboring structures, or lymphatic or blood-vessel migration and metastasis; (2) abnormality of cell structure with the appearance of either primitive cells or cellular monstrosities; (3) reproductive activity as evidenced by the appearance of mitoses.

What are the bounds of thyroid cells? Bloodgood,<sup>2</sup> Goetsch,<sup>6</sup> and others have called attention to the fact that in the normal thyroid there are two types of cells—those forming the acini, which have a more or less definite basement membrane, and certain interstitial epithelial cells lying loosely between the acini. These latter seem to have no definite boundaries, and some observers have said that their proximity to blood-vessels makes it relatively easy for such cells to get into the blood-stream and start up metastases of normal thyroid tissue. These cells are present in still larger numbers in the adenomata and especially in the fetal adenomata. Therefore, in the examination of these specimens, it is difficult to say whether the cells are growing "out of bounds" or not. Some pathologists would even demand other proof than metastasis, *i.e.*, some changes in the cells themselves, before calling them malignant.

## METASTASIZING THYROID TUMOR

In other tumors the presence of undifferentiated or primitive cells is considered to be an evidence of malignancy, but primitive (fetal) cells are present in the normal thyroid and present in large numbers in the benign adenomata. Do these cells, in adult life, ever develop into normal thyroid follicles by the process described by Bloodgood<sup>2</sup> for the development of the fetal thyroid? Is this process going on all of the time as the body requires more thyroid secretion during adolescence or in the ordinary "turnover" of cells to replace those lost during the ordinary wear and tear of cellular activity? We have not seen this question answered, but it seems logical. If there is any perversion of this growth we have the "wucherende struma" of Langhans<sup>3</sup> which he says "resembles the normal organ undergoing development." May not a perversion of the development of similar fetal cells in other glands be the origin of malignant tumors elsewhere, rather than the sudden stimulation of embryonal cell "rests" or a "reversion" of adult epithelium? Such primitive cells are certainly present in the mammary gland and probably also in the testes, ovaries and uterus. Their demonstration in other glands like the stomach or colon is more difficult. Should any of these primitive fetal thyroid cells be called abnormal until they have shown definite perversion in their development? Again we must ask what are the criteria of perversity? This is a question as yet unanswered. It is in this relatively wide zone that the young pathologist is lost and even experienced pathologists disagree with regard to thyroid tumors. These disagreements make Cohnheim<sup>4</sup> and others believe that normal thyroid or benign thyroid tumors may metastasize, and Bérard and Danet,<sup>1</sup> von Eiselsberg,<sup>15</sup> and others denounce such theories as worse than heretical. These disagreements make Bloodgood<sup>2</sup> and others say that one rarely finds a history of preceding tumor growth in malignant thyroid tumors, while Wilson,<sup>16</sup> Plummer,<sup>12</sup> Speese and Brown,<sup>14</sup> and others say that they find it in nearly every case. These disagreements make Bloodgood<sup>2</sup> generally find clinically benign tumors pathologically benign, and Wilson<sup>16</sup> find clinically benign tumors frequently pathologically malignant. These disagreements make Wilson<sup>17</sup> and others say that they believe that practically all malignant tumors arise from fetal adenoma, and Speese and Brown<sup>14</sup> and others claim that other forms of benign tumors are more often antecedent. The problem now seems to be to narrow this zone of disagreement down so that the pathological cell will be more easily distinguished, so that more correct diagnoses can be made and so that more accurate prognoses can be presented to the patient. Even the criterion of cellular reproductive activity is not quite so simple as in other tumors, because the slow growth of some thyroid tumors makes mitotic figures very hard to find while, on the other hand, mitotic figures are frequently found in benign proliferations such as in the hyperplasia of exophthalmic goitre.

This all goes to show that at present the diagnosis of malignant tumors of the thyroid is very difficult, and until more data are supplied the criteria

of malignancy will be very hard to define. Until that time, the most accurate diagnoses will be made by the pathologist of greatest experience who has been able to check up his pathological observations by exact clinical follow-up data.

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## SUPPURATIVE OSTEOMYELITIS DUE TO THE COLON BACILLUS

BY NATHAN WINSLOW, M.D.

OF BALTIMORE, MD.

FROM THE SURGICAL DEPARTMENT OF THE UNIVERSITY OF MARYLAND

As recently as 1893, Déhu, *Thèse Paris*, p. 91, states that the *B. coli communis* had never been seen in bone abscess. Cushing, writing seven years later in the *Johns Hopkins Hospital Bulletin*, 1900, vol. xi, p. 160, says a colon infection only occasionally passes beyond the confines of the abdominal cavity. Judged by the number of case reports, six only, suppurative osteomyelitis of colon bacillus origin is indeed uncommon. A case of this kind having come under our observation, an account of the essential features should not be without interest.

The patient, a white male, aged fifty-two, farmer, married, entered the University Hospital, Baltimore, March 15, 1922, in the service of Dr. Compton Riely, on account of a swelling in the lower end of the right thigh which had rendered him a bedridden cripple. He was unaware of ever having injured the limb, and could assign no reason for its appearance. He had had typhoid twenty years previously and in 1918 a mild attack of influenza, from both of which he had recovered without complications. With these exceptions he had always enjoyed excellent health. On October 15, 1921, he was seized without warning with severe pains in the thigh at the site indicated. A close inspection of the place of soreness led to the discovery of a small lump. From the very onset the agony was so intense as to compel the patient to go to bed. Shortly after the beginning of the attack the skin took on a purplish hue and during the latter part of December broke, discharging a large amount of pus. Manipulation of the leg was objected to on account of the excruciating pain excited thereby. After a few weeks bed-sores developed, first on the left heel, then in rapid succession on the outer side of the right hip and over the sacrum. On admission the lower part of the right thigh was found to be very much swollen, and fluctuated behind. On March 18, 1922, under one-half per cent. procaine infiltration, a free incision was made in the back of the thigh, at the junction of the middle and lower thirds, by Doctor Riely, and a large quantity of thick, yellowish pus with the characteristic stench of the colon infection evacuated. On March 29th, a small sinus opened on the inner side of the thigh, the track of which was found to communicate with the pocket opened March 18th. Through-and-through drainage was now instituted and the abscess cavity irrigated daily with a 2½ per cent. formalin solution followed by a copious normal salt washing. By April 18, 1922, the leg was pus free and the patient's health decidedly improved. The wound had completely healed by August 10th, but the decubitus over the sacrum had not entirely cicatrized. The temperature which had been as high as 102 degrees F. was normal; the pulse had dropped from 120 to 80 and the respirations had descended from 30 to 20. A white blood-cell count made shortly after admission was 12,000; the red cells were 3,400,000. The differential picture was polymorphonuclears 62 per cent., small mononuclears 35 per cent., large mononuclears 3 per cent. The hæmoglobin was 65 per cent. The non-protein nitrogen was estimated as 27 mg. per 100 c.c. of blood; the urea 14 mg.; and the blood sugar as 90 mg.

Bacteriological studies of the pus obtained from the abscess opened March 18, 1922, showed exclusively the colon bacillus. In so far as the attack of typhoid preceded the bone lesion by twenty years, and there had never been the least intimation of its presence from convalescence till the date of the initiation of the present illness, the probability is the bone disease arose entirely independent of the earlier infection. Force is lent this conclusion by the patient's serum failing to agglutinate the typhoid or either paratyphoid group, but it did clump the organisms grown from the pus collected from the thigh in the dilution of 1 to 100, quite promptly. Though no animal inoculations were made, the organism had all of the cultural and morphological characteristics of the *B. coli*.

This case is presented as an example of an osteomyelitis from an organism which has been but seldom isolated either in pure or mixed culture from the pus of bone abscess. Whether the bone infection had any connection with the attack of typhoid or not, the association of the colon bacillus with an osteomyelitis is of clinical interest.

Berg (*Nord. Med. Archiv.*, 1895, n.s., vol. v, p. 44, translated for this paper by C. R. Ahroon, University of Maryland) reports a very similar case. The patient, a male, aged twenty-seven, had noticed for about a month in the third right costal cartilage near the edge of the sternum a nut-sized swelling of acute tenderness and adherent to the bone for which no cause could be assigned. As it was increasing in size, the man sought medical advice. On admission, September 3, 1895, there was an oval, hard, elastic tumor with a soft centre, located in the region of the right third costal cartilage. The overlying skin was normal; no lymph-glands were palpable; no demonstrable changes in the inner organs; no fever. No diagnosis was made. Exploratory incision developed a small cavity beneath the pectoral muscle filled with a thin pus, in the bottom of which lay a diseased costal cartilage. The entire cartilage was excised and the wound closed loosely. Healing took place promptly. Microscopical examination for the tubercle bacillus was negative. Guinea-pigs, inoculated intraperitoneally with some of the pus as well as subcutaneously, died in fourteen days. Sections from these animals showed no tubercle organisms; but fluid from the peritoneum, spleen, liver and heart contained the same bacterium as that of the pus implanted in agar. At the site of the subcutaneous injections, abscesses, filled with thick pus, formed. No tubercle bacilli were found in this exudate. Cultures made at the time of the operation in agar showed the *B. coli communis* alone.

The next case is recorded by Blumer (*The Pacific Record of Medicine and Surgery*, 1898, vol. xiii, p. 105). The patient, a woman, aged forty-five, in April, 1897, passed through a "typhoid" attack of moderate severity. The disease ran a course of twenty-eight days. In the fourth week of the illness the patient began to complain of pain at the point of junction of the fourth rib with the sternum, where a small, deep-seated nodule soon appeared. There was no redness of the overlying skin; no oedema. A collection of pus was suspected, so the area was aspirated but without result. The patient returned home and was not seen again until October 12, 1897, when she was readmitted for a lump in the left chest which had been of a gradual development. The mass was removed whole, but the wound never healed, a sinus persisting which discharged a thin sero-pus. At a second operation in January, 1898, the rib was found necrosed at its point of union with its cartilage. The diseased bone was removed and the wound packed. Then healing was rapid and the patient has since enjoyed good health. The *B. coli* was the only organism isolated from the pus. In this case Cushing thought the evidence adduced hardly justified the claim in that the organism

## OSTEOMYELITIS DUE TO THE COLON BACILLUS

recovered was an alkali producer. He was more inclined to regard its proper place as intermediate between the typhoid and colon groups.

Martina (*Arch. f. klin. Chir.*, 1907, vol. lxxxiii, p. 906) also cites a case of costal chondritis due to a colon bacillus infection. The patient, a man, aged forty-seven, was attacked September 15, 1905, with a moderately severe fever of four weeks' duration which was diagnosed typhoid. Six weeks after the onset of the malady the patient noticed in the region of the right third costal cartilage a small mass which by November 23, 1905, had attained the size of an orange. It was not accompanied by fever and caused pain only when the body was jarred. He was admitted to the hospital, November 23, 1905, for a deep-seated swelling which fluctuated. It was aspirated with the recovery of a thin purulent liquid which was immediately inoculated into various culture media. On November 24th, under local anaesthesia, Payr made a free incision into the abscess and emptied it of its contents. Although the cartilage was well exposed, no damage was detected to its perichondrium. Under the assumption the abscess was of the soft parts exclusively, a few sutures were placed at the angles of the wound and the cavity packed with gauze. Three weeks later the wound had contracted down to a small channel which secreted occasionally a few drops of pus. Notwithstanding the employment of various measures, the sinus remained refractory and declined to heal. Therefore three months after the first operation, the man was induced to submit to a second intervention. On this occasion, February 20, 1906, under general anaesthesia, the fistula was slit down to the cartilage which was exposed in its entire length. As the cartilage was now extensively necrosed, it was completely removed. The wound was solidly united in four weeks. From the pus obtained at aspiration the colon bacillus was isolated in pure culture.

The latest to report the recovery of the bacterium coli in pure culture from the pus of a bone abscess is Satta (*La Chirurgia degli Organi di Movimento*, 1922, vol. vi, p. 105). His patient, a man, aged thirty, was wounded in the left leg, September 15, 1916, with a piece of shell. At the same time the tibia suffered a comminuted fracture which became rapidly infected. Not until February 25, 1917, after five months of constant care, was the limb pronounced well. According to the patient's statement the discharge had been unbearably offensive. He had never been operated upon. On April 25, 1917, the temperature ascended and he was suddenly seized with intense pain at the seat of the fracture. As the agony did not subside, he was promptly returned to the hospital, the edges of a scar located on the antero-internal aspect of the upper third of the left leg, were red and brawny. The involved area was exquisitely tender on pressure. X-ray examination revealed an osteomyelitis without a visible foreign body. Hence on May 14, 1917, an incision was made down to the tibia. The periosteum when slit gave exit to a collection of thick, yellowish, stinking pus mixed with gas. At a spot in the cortex of the bone was a greenish scab which marked a point of softening and purulent infiltration. While reaming away this debris the curette slipped into a medullary pocket full of the same kind of pus. Though the bone was widely opened and drained, the temperature continued high and the boggiess extended into the neighboring tissues, necessitating on May 17th a new incision, which released a subaponeurotic and intramuscular collection of similar character. Notwithstanding the wound was now energetically Dakinized, no improvement followed; consequently a low thigh guillotine amputation was done May 28, 1917. As there was still no abatement in the temperature and the stump continued to secrete an abundance of evil-smelling matter, an autogenous vaccine was prepared and injected daily in progressively increasing dosage. On June 7th, an abscess formed in the left gluteal region which crepitated on palpation. This when lanced contained a pus identical in all respects to that collected from the medulla. Not until June 9, 1917, did the

patient begin to show any improvement. Shortly thereafter the femur extruded a sequestrum and the wound had cicatrized sufficiently for the man to be discharged July 28, 1917. From the morphological characteristics and the cultural picture the bacterium isolated from the tibial abscess was certified as the colon bacillus. The serum of the patient did not agglutinate this organism. Blood cultures were apparently neglected. Whether the microbe was carried into the wound and had lain dormant for five months, or whether it was transported there by the blood-stream at a later date, is impossible of proof. In either event the fracture must have afforded a favorable pabulum for its propagation.

In the two following cases the colon bacillus was found mixed with the bacillus of Eberth.

Klemm (*Arch. f. klin. Chir.*, 1894, vol. xlviii, p. 793) reports the case of a girl, aged sixteen, who showed near the close of a severe and typical typhoid fever, a sudden increase in the severity of the symptoms with the appearance of a marked swelling at the middle of one thigh. She had been sick eight days when she entered the hospital, October 24, 1893. It was not until November 8th, that the fever broke in the morning, but there was always a slight evening rise. December 7th, an abscess formed in the neighborhood of the right great trochanter. This was promptly incised. On December 13th this incision had to be extended. The thigh was then held in constant flexion at the hip-joint. In order to prevent a permanent contracture, the limb was put up in extension, but the patient complained so bitterly of the arrangement that the apparatus had to be removed December 18th. The same day the patient had many chills and the temperature ascended. December 21st, a puffiness was noticed at the middle of the left thigh. The affected area was exquisitely tender and the overlying skin was intensely injected. The girl by that time was in a state of collapse. On December 23, 1893, this swelling not only fluctuated, but was accompanied by a crepitation, and the emphysematous area on percussion gave a tympanitic note. An aspiratory puncture was rewarded with the recovery of a few drops of pus, and from the path made by the needle a stinking hissing gas escaped. On December 25th, a spontaneous fistulization occurred, from the mouth of which poured a quantity of brownish-red, ill-smelling matter. The patient died December 28, 1893, in collapse. Both the typhoid and colon bacillus were isolated from the pus obtained by aspiratory puncture, December 23, 1893. At autopsy the left femur was devoid of periosteum and the cortex was necrotic, but no pus was seen in the central canal.

Arcoleo (*Il Morgagni; Giorn. Indir. al. Prog. della Med.*, Milan, 1899, vol. xli, p. 653) reports the other case of mixed typhoid and colon bone infection. The patient, a woman, aged twenty-one, was taken ill of typhoid on May 2, 1898. The disease ran a course of six weeks. During convalescence she noticed a tumefaction in the great trochanter of the right hip and ten days later a swelling at the middle of the anterior surface of the left thigh. The skin was red, tender to pressure, and the mass fluctuated. There was a sense of crepitation on palpation of the soft tissues and a tympanitic note was present. The right thigh was incised, but the left only aspirated for the purpose of obtaining some pus for bacteriological study. With the withdrawal of the syringe a few bubbles of fetid gas escaped. Next morning the abscess opened spontaneously, giving exit to a large quantity of brownish-red pus. The patient died in collapse the same day. At autopsy nothing of interest was found except an osteomyelitis of the left thigh.

Other instances of bone inflammation, with the colon bacillus playing the etiological rôle, may be on record, if so, I have no knowledge of them. It is true that Klemm (*Beitr. z. klin. Chir.*, 1913, vol. lxxxiv, p. 408) says of 320



## OSTEOMYELITIS DUE TO THE COLON BACILLUS

osteomyelitides, 280 were examined bacteriologically, with the isolation of the colon bacillus once, but other than tabulating the case as occurring on pp. 378 and 402, no information is forthcoming. This is obviously the case reported by Klemm in *Arch. f. klin. Chir.*, 1912, vol. xcix, p. 455. The patient, aged nine months, was brought to the hospital for an increasing and fluctuating swelling of the right shoulder of two weeks' duration. Lancing of the abscess served a twofold purpose—the release of much purulent matter from the joint and the disclosure of a pus pocket in the head of the humerus. Erasion of the débris effected a cure. Although the colon bacillus was found in the pus, the case has been omitted as an example of this type of osteomyelitis, as the main force of the inflammation was directed against the joint.

The condition is of interest mostly from the fact that under circumstances of which we are ignorant, this organism, either alone or in association with other germs, can cause bone suppuration. Four of these patients were men; three, women. The age seemed to have played no part in the incidence, viz., sixteen, twenty-one, twenty-seven, thirty, forty-five, forty-seven, and fifty-two years, respectively. The bones involved were: femur three times; costal cartilages thrice; tibia once. The two cases with mixed infection died. The patient in whom the organism was recovered from the tibia recovered only after an amputation through the thigh. The three instances of costal chondritis all recovered after complete extirpation of the cartilage involved. The man suffering with the infection at the lower end of the femur has been cured of the osteomyelitis, but is still confined to the hospital on account of a cicatrizing sacral decubitus.

In those cases in which the colon bacillus was recovered in pure culture but a single bone was involved whilst in the instances of mixed infection both femurs were diseased. In one case no diagnosis was made; in one the bone lesion followed a gunshot fracture of the tibia; whilst in the remaining five the patient had had typhoid-like attacks. The time of the appearance of the lesion was: Initial lesion, 1; fourth week of illness, 1; near the close of a typical typhoid, 1; six weeks after onset of typhoid, 2; five months after the receipt of injury, 1; twenty years after the attack of typhoid, 1.

Too few cases have been published to offer any definite conclusions. It would appear from the cases reported that this type of osteomyelitis may occasionally undergo spontaneous resolution; that it may occur in either an acute or chronic form; that it has periods of quiescence and activity; that a most thorough eradication of the diseased bone is sometimes necessary to effect a permanent cure; that vaccine treatment may prove a valuable adjuvant in stubborn cases. The prognosis is relatively favorable, as regards life, only two cases of this series dying, both of which were mixed infections and of a very acute type. Unfortunately blood cultures were made in none. I am inclined to believe this type of osteomyelitis would be encountered more frequently were bacteriological studies made in all cases of bone abscess.

## THE TREATMENT OF CHRONIC EMPYEMA WHERE THE RECOGNIZED SURGICAL PROCEDURES HAVE FAILED TO PRODUCE OBLITERATION

By WILLIAM L. KELLER, M.D.

LIEUT. COL. MED. CORPS, U.S.A.

*Continued from page 580*

CASE IX.—H. T., age twenty-four years, developed influenza followed by lobar pneumonia, January 22, 1919, and the latter complicated by empyema, right

pleural cavity, January 26, 1919, hæmolytic streptococcus type. Later developed otitis media, acute, catarrhal, right.

Patient had four operations prior to admission to Empyema Service with resection of the fourth to tenth ribs inclusive.

Admitted to Empyema Service, November 26, 1920.

Condition on admission: Ambulatory, general condition good; normal weight 140 pounds; present weight 127 pounds.

Examination of chest reveals sinus discharging pus, tenth interspace. Ra-

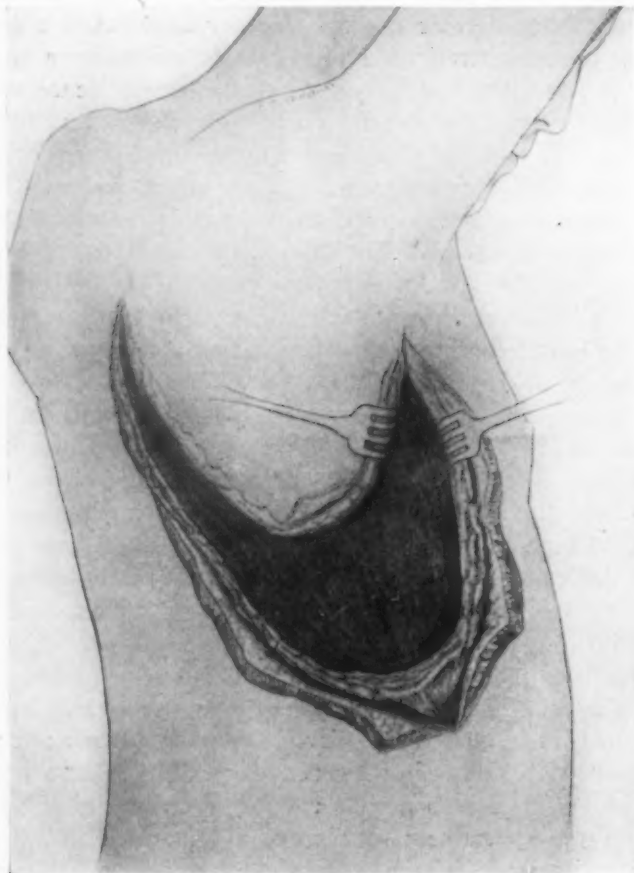


FIG. 25.—Case IX. First step of fractional operation.

diograph shows marked collapse of right chest wall with elongated bismuth-filled cavity, approximately 16 cm. in length, and 2.5 cm. at its widest portion in the lateral portion of the chest just under the soft tissue covering. This cavity runs from the tenth interspace to the fifth interspace, axillary line. There has been a resection of the fourth to tenth ribs, right side. Cavity shows smooth outlines with no evidence of diverticulæ or bronchial fistulæ.

## TREATMENT OF CHRONIC EMPYEMA

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; urine negative; red blood-cells, 4,880,000; white blood-cells, 8800; hæmoglobin, 85 per cent. Blood-pressure: systolic, 120; diastolic, 80; pulse-pressure, 40; vital capacity reading not taken. Culture from cavity showed hæmolytic streptococci and staphylococci aureus.

*Surgical Treatment, Fractional Procedure.*—December 2, 1920. The first step of the fractional type operation was accomplished. The upper angle of the wound was attacked, ribs resected, and the old cavity laid widely open at this point. A portion of the serratus magnus, the rhomboideus major and subscapularis muscles implanted immediately into the cavity and sutured into place (Fig. 25).

The muscle bodies held and there was practically no sloughing following this operation.

January 17, 1921. An incision at the lower angle of the old wound was made, the scar tissue was excised and multiple sinuses were found leading in all directions. Sinuses curetted and the wound left open.

Patient placed on active

Dakinization. His condition seemed to be improving somewhat and it was decided to refrain from further operative procedure until there was a more definite improvement in the general condition. Capacity of cavity at this time, 200 c.c.

April 5, 1921. Resection of third to eighth ribs over anterior and lateral chest wall; cavity laid wide open. The apex of cavity was found to be obliterated following the muscle implantation at previous operation.

July 6, 1921. Patient has obliterated his cavity rapidly, but there is evidence of osteomyelitis of the terminal seventh, eighth and ninth rib stumps. Necrotic rib stumps resected.

July 27, 1921. A sliding skin flap with its subcutaneous fat twisted on its

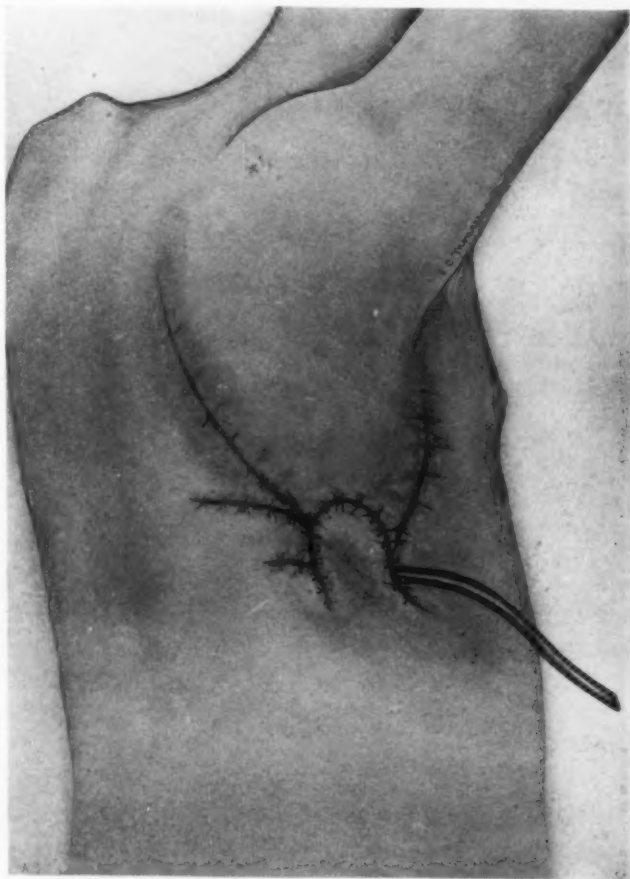


FIG. 26.—Case IX. Result after fifth step.

WILLIAM L. KELLER

pedicle and transplanted into the lower angle of the wound, entirely closing this part of the cavity. A small part of the cavity remaining above this point can be obliterated by lung expansion on forced inspiration of the patient (Fig. 26).

September 19, 1921. Sinus tract allowed to close as patient has had seven consecutive daily sterile cultures.

November 1, 1921. Patient entirely healed.

December 6, 1921. Patient given thirty-day leave.

January 6, 1922. Returned from leave feeling fine, entirely healed; ready for discharge from hospital.



FIG. 27.—Case IX. Final result.

January 31, 1922. Patient discharged from hospital cured this date. X-ray taken prior to discharge showed rather marked collapse of chest wall, especially at the base, but no evidence of cavity (Fig. 27).

Factors to be combated in this case are:

1. Hemolytic streptococci and staphylococci aureus present.

2. Osteomyelitis of terminal rib stumps.

CASE XI.—  
R. C. W., age thirty years, received gunshot wound, multiple wounds, right

chest and right leg, October 6, 1918, in action. Developed broncho-pneumonia, traumatic complicated by empyema, October 17, 1918. Aspirated twice.

November 1, 1918. Thoracotomy with resection  $1\frac{1}{2}$  inches, tenth rib, right. Lower wound allowed to close, but pus continued to drain through upper gunshot wound of chest.

December 8, 1918. Operation.—Thoracotomy with resection of part of eighth rib, right. Dakinization attempted but not carried out, on account of pleuro-bronchial fistula.

April 8, 1919. Operation.—Resection of part of seventh rib, right, mid-axillary line. Tube drainage.



## TREATMENT OF CHRONIC EMPYEMA

July 5, 1919. Resection of fifth, sixth and seventh ribs, mid-axillary line, right. Dakinization of wound followed.

Drainage of wound continued; various antiseptic solutions being used, including gentian violet and bismuth paste. The cavity remained unobliterated and he continued to drain pus.

Admitted to Empyema Service, January 20, 1921.

Condition on admission: General condition good; has gained markedly in weight since original injury. Examination of chest shows a sinus at level of the

eighth rib, posterior axillary line, right chest. Sinus too small to admit tube drainage. Profuse discharge of thick pus on dressing. Radiograph shows a partial resection of parts of the fifth, sixth and seventh ribs, anterior axillary line, with resection of part of the ninth rib. There has been proliferation of the rib ends with union and cross-union of previously resected ribs. Cavity runs posteriorly along the diaphragm, then upward to sixth rib posteriorly. Cavity lies about the scap-



FIG. 28.—Case XI. Showing result of muscle implantation.

ular line and about 6 cm. from the mid-line of spine. Thickened pleura over entire right chest. Capacity of cavity about 500 c.c.

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; urine negative; culture from cavity showed gram-positive bacilli; non-haemolytic; staphylococcus aureus present. Blood-pressure: systolic, 130; diastolic, 84; vital capacity, 2400 c.c.

*Surgical Treatment, Fractional Procedure.*—February 2, 1921. Incision along old sinus tract; resection of sixth, seventh and eighth ribs over cavity; exposure of entire cavity with removal of parietal pleura and intercostal tissues. Excision of the sinus tract; dissection of the visceral pleura. The cavity and wound

WILLIAM L. KELLER

were packed with gauze and Carrel tubes and active dakinization of the cavity started.

The extent of cavitation can be judged by the fact that at the daily dressings some forty-two Carrel tubes were laid in the cavity between the layers of gauze.

The cavity became clinically and bacteriologically clean within a short time. The capacity of the cavity diminished with remarkable rapidity. At the time of the first plastic operation April 1st, the cavity had obliterated about fifty per cent.

Frequent scarifications of the visceral pleura were made and this apparently

hastened the obliterative process by permitting reexpansion of the underlying lung.

April 1, 1921. Removal of sequestrum of eighth rib. The cavity being sterile, a plastic closure of the upper angle of the cavity was done. Contiguous muscle bodies at the lateral margin of the wound were partially split and swung into the cavity and sutured *in situ* to the visceral pleura and sides of the wound. Following this implantation, there was slight superficial necrosis of the muscle implant,



FIG. 29.—Case XI. Final result.

but the greater part of it became adherent and obliterated to a great extent the upper half of the wound and cavity (Fig. 28).

June 3, 1921. Plastic closure of remaining cavity in its lower half. The upper half was now completely obliterated from the previous plastic operation. Plastic closure was done as in the upper half by the implantation of a large muscle plane. Skin and superficial tissues were brought into apposition and the wound closed with rubber tissue drainage.

The wound healed with the exception of a small sinus, which persisted, and continued to drain a slight amount of sero-purulent exudate.

July 12, 1921. Incision along lower part of old scar laying open a branched

## TREATMENT OF CHRONIC EMPYEMA

sinus tract. This was lined with infected granulations but no rib involvement could be found. It was curetted and left open for Dakin treatment. The old cavity was practically entirely obliterated.

September 16, 1921. Operation.—Final plastic to restore contour of chest wall. Small gutter depression along lower part of old cavity closed by suture of opposing muscle bodies and skin.

Recovery uneventful; wound healed two weeks following last plastic operation.

Patient granted several sick leaves and kept under observation until May 11, 1922, when he was discharged cured, having been healed seven months. (Fig. 29.)

Factors to be combated in this case are:

1. Haemolytic streptococcus, staphylococcus aureus and pyocyanus organisms present prior to admission.
2. Extremely large cavity.
3. Osteomyelitis with sequestration of rib stumps.
4. Marked lung collapse with dense adhesions and greatly thickened visceral pleura.

Terminal examination shows no cavity formation clinically or by radiograph. Fair lung expansion on the involved side. There is but slight deformity of the chest wall. General condition of patient excellent.

CASE XIII.—C. A. M., age nineteen years, developed pneumonia, January 25, 1920, complicated by empyema, right pleural cavity, haemolytic streptococcus type. February 1, 1920. Aspirated five times.

May 5, 1920. Thoracotomy with resection of 5 cm. of eighth rib. Intermittent dakinization; drainage continued up to time of admission.

Condition on admission: General condition good; slight anaemia; weight normal, 200 pounds.

Examination of chest reveals sinus discharging pus at the level of the eighth rib, mid-axillary line, right side. X-ray examination showed sinus at the level of the eighth rib leading into a cavity about 20 cm. in depth, which extends backward and upward, following the course of the seventh, eighth and ninth ribs; capacity of cavity, 250 c.c.

Laboratory examinations: Wassermann negative; urine negative; sputum negative for tubercle bacilli; red blood-cells, 4,500,000; white blood-cells, 5200; haemoglobin, 75 per cent.; culture from cavity shows streptococcus haemolyticus.

*Surgical Treatment, Fractional Procedure.*—January 17, 1921. Resection of 20 cm. of the eighth, ninth and tenth ribs with excision of sinus tract leading to the spinal gutter. A second sinus tract was found leading to the posterior diaphragmatic sulcus. The original sinus and ribs surrounding it were not touched at this operation; cavity left wide open for active Dakinization (Fig. 30).

March 14, 1921. Second step of fractional operation done. Excision of sinus tract with resection of about 10 cm. of ninth rib; cavity left open for Dakinization.

Following these operations patient obliterated his cavity rapidly.

May 12, 1921. The cavity at this time was less than one-fourth its original size; a plastic closure was done; implantation of part of the serratus magnus to fill the remaining unobliterated portion and sliding skin flaps were brought forward from each side and sutured. (Fig. 31.)

June 5, 1921. Wound healed; general condition excellent.

August 11, 1921. Patient discharged, healed two months. Cured. (Fig. 32.)

Factors to be combated in this case are:

1. Haemolytic streptococcus organism present.
2. Osteomyelitis of terminal rib stumps.
3. Diverticulæ or accessory pockets.

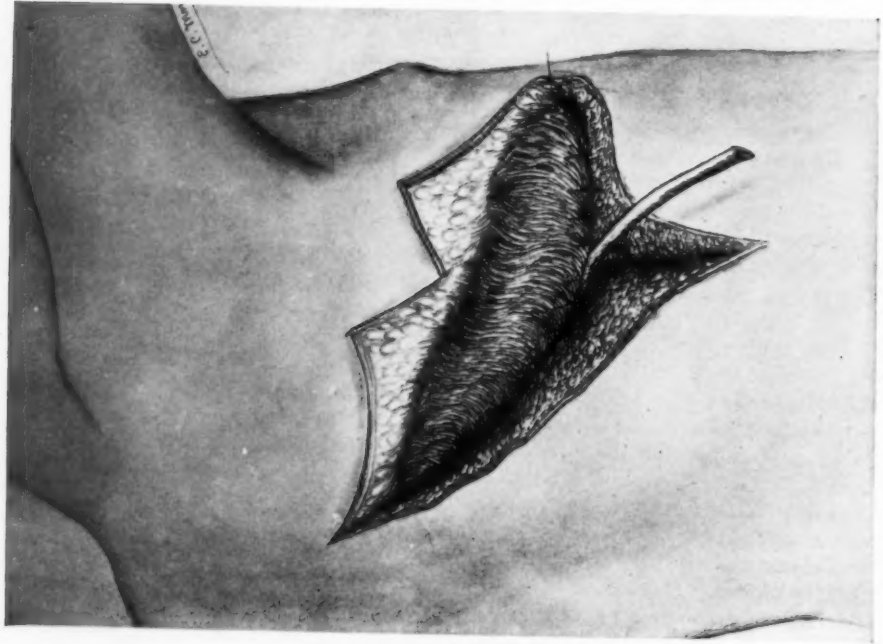


FIG. 31.—Case XIII. Result of plastic muscular implantation.

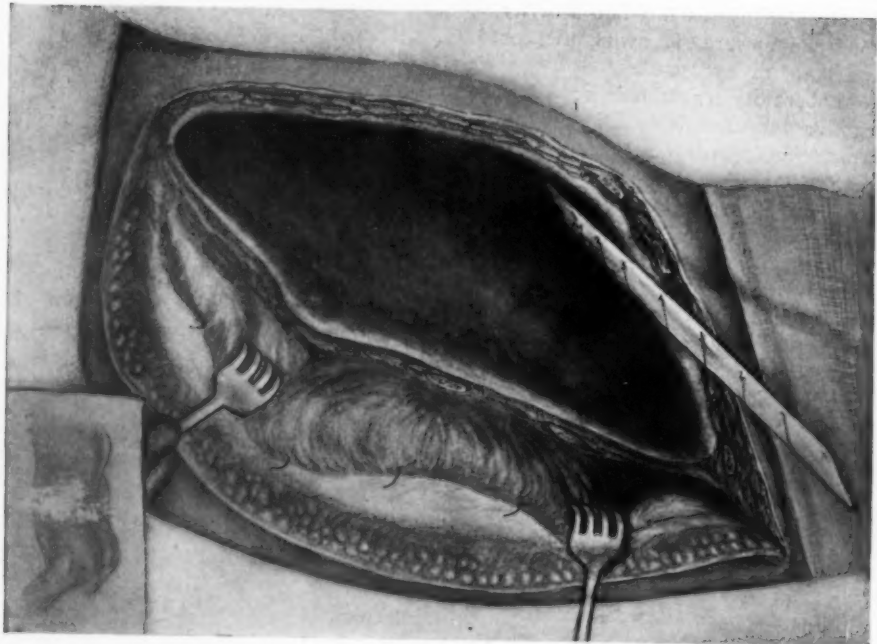


FIG. 30.—Case XIII. Showing extent of primary rib resection, and magnitude of cavity.



## TREATMENT OF CHRONIC EMPYEMA

CASE XV.—O. C., age twenty-eight years, developed influenza and pneumonia, September 15, 1918, complicated by empyema, left pleural cavity, hæmolytic streptococcus type, October 10, 1918; aspirated twice.

October 16, 1918. Operation.—Thoracotomy, resection of portion of sixth rib mid-axillary line, drainage and irrigation of cavity with Dakin's solution.

November 17, 1918. A secondary drainage operation was done, with removal of a portion of the seventh rib.

August 22, 1919. Decortication operation with resection of portions of fifth, sixth, seventh, eighth, ninth and tenth ribs and drainage of the lower aspect of the cavity.

September 17, 1920. Resection of an additional portion of eighth rib stump and the resection of 5 cm. of the third and fourth ribs, posterior scapular line, left chest.

Following this the patient would heal and break down with a persistent expectoration of blood from pleuro-pulmonary communications.

Admitted to Empyema Service, February 10, 1921.

Condition on admission:

Ambulatory case, anæmic, poorly nourished and considerably under weight; normal weight 145 pounds; present weight 127 pounds; extremely toxic with renal complications, chronic interstitial nephritis.

Examination of chest: Revealed great deformity in the contour of the left lateral chest with an "axe-chop" appearance and a sinus discharging pus mid-axillary line.

Radiographs showed marked collapse of the left lung with extensive thickening of the pleura from apex to base and a cavity formation extending from the third to the eighth rib, left lateral chest, with a capacity of 250 c.c. A pleurobronchial fistula was present and osteomyelitis of resected rib stumps noted.



FIG. 32.—Case XIII. Final result.

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; white blood-cells, 13,560; red blood-cells, 3,970,000; urine showed heavy trace of albumin and hyaline and granular casts. Culture from cavity showed hemolytic streptococcus. Blood-pressure: systolic, 144; diastolic, 86; pulse-pressure, 58; vital capacity reading, 1600 c.c.

*Surgical Treatment, Fractional Procedure.*—February 18, 1921. Operation.—Incision along line of old scar, cavity laid wide open; necrotic rib stumps removed; excision of thickened parietal pleura forming roof of cavity; discission of visceral

pleura to allow lung expansion; all skin and muscles preserved for final closure and preparation of cavity for active Dakinization.

June 9, 1921. Operation.—Partial closure with the suturing of the fistula present and the implantation of a portion of the latissimus dorsi muscle over same; upper aspect of cavity closed, muscle and skin; lower portion left open for active Dakinization. (Fig. 33.)

September 13, 1921. Incision of sinus tract leading posterior and upward communicating with

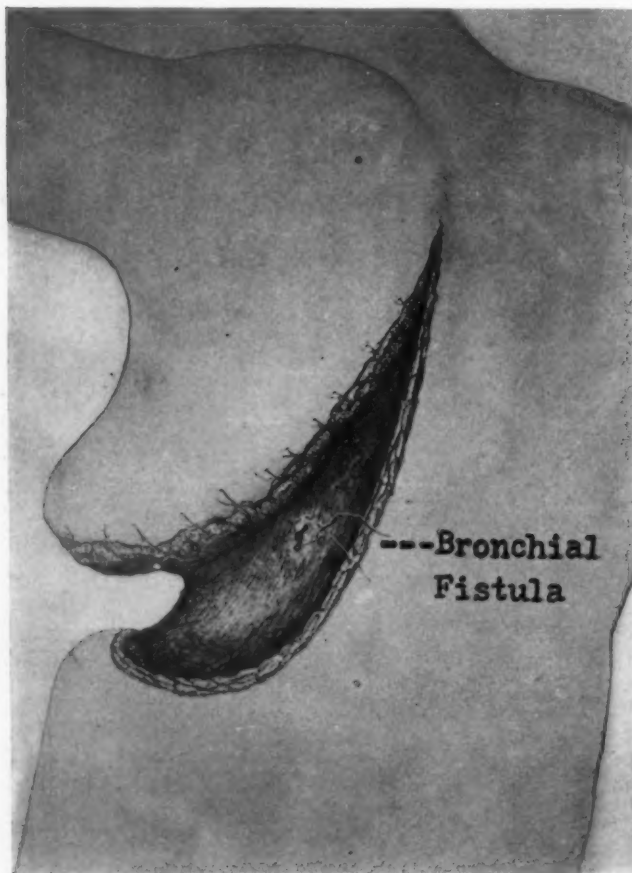


FIG. 33.—Case XV. Showing suture of bronchial fistula.

the main cavity, the same left wide open for active Dakinization.

October 1, 1921. Cavity sterile by seven consecutive daily cultures.

October 5, 1921. Resection of 5 cm. of the regenerated fifth and sixth ribs.

posterior scapular line. Discission of visceral pleura; fistula is closed. Plastic flap of the subscapularis muscle implanted in upper aspect of remaining cavity; superficial muscles brought in apposition and sutured; skin closed with figure-of-eight silkworm gut; multiple scarifications of skin to cause relaxation; lower aspect of wound left open to granulate. (Fig. 34.)

November 30, 1921. Patient entirely healed and gaining weight. X-ray

## TREATMENT OF CHRONIC EMPYEMA

shows all cavity formation obliterated; general condition excellent; urine negative for albumin or casts. Weight on admission 127 pounds; present weight 148 pounds; vital capacity reading, 2400 c.c.

March 1, 1922. There is a small trophic ulcer in the area of the old scar which is being strapped and is gradually becoming smaller. Patient's general condition excellent; appetite good; has taken on weight and strength and will soon be ready for final disposition. (Fig. 35.) Factors to be combated are:

1. Hæmolytic streptococcus organism present.

2. Pleuro-bronchial fistula present.

3. Osteomyelitis of rib stumps.

4. Secondary cavity formation.

5. Chronic interstitial nephritis.

6. Marked collapse of left chest wall due to previous operative procedure.

April 4, 1922. Patient entirely healed and discharged from hospital cured.

CASE XVII.  
W. G., age thirty years, developed influenza and pneumonia, October 1, 1918, complicated by empyema, right pleural cavity, hæmolytic streptococcus type, October 13, 1918. Aspirated once.

October 15, 1918. Operation.—Intercostal thoracotomy eighth interspace, posterior axillary line, with the institution of drainage.

December 23, 1918. Thoracotomy with resection of a portion of the eighth rib, posterior axillary line, and better drainage instituted.

September 24, 1919. Decortication operation with resection of a portion of fifth, sixth, seventh, eighth, ninth and tenth ribs with complete decortication of visceral pleura and wound closed with dependent drainage. Following this operation, there was a slough of the soft tissues along posterior incision and a protrusion of rib stumps into opening with exposure of nerve ending from posterior



FIG. 34.—Case XV. Showing final muscular implantation.

WILLIAM L. KELLER

horn cells. Dressings very difficult at this time; Dakin solution tried but discontinued on account of bronchial fistula, which caused patient to strangle; iodoform emulsion used in dressings; mercuracrome also tried. Patient exposed to sun rays and to various forms of tub baths. Treated by these various methods until September 23, 1920.

Admitted to Empyema Service, September 24, 1920.

Condition on admission: Litter case, anæmic, highly septic, poorly nourished,



FIG. 35.—Case XV. Final result.

and considerably under weight; normal weight 140 pounds; present weight 96 pounds. General condition extremely poor. Examination of chest revealed large open wound, posterior scapular line, with retraction of soft tissues in this area, and exposed necrotic posterior rib stumps fifth, sixth and seventh, with considerable unhealthy granulations about same; posterior horn cells exposed and patient extremely sensitive over this area. This open wound communicated with his cavity

formation, which has a capacity of 650 c.c. (Fig. 36.)

Radiographs showed almost total collapse of right lung with extensive thickening of the pleura, right chest, from apex to base, and a large cavity formation extending from first to tenth rib, lateral chest. A large pleurobronchial fistula noted; marked osteomyelitis of resected rib stumps. A cold abscess was present over right sacro-iliac region.

Bacteriological examination: Wassermann negative. Sputum negative for tubercle bacilli; white blood-cells, 9750; red blood-cells, 3,750,000; urine negative. Culture from cavity showed heavy growth of hæmolytic streptococcus. Blood-pressure: systolic, 108; diastolic, 76; pulse-pressure, 32; vital capacity reading, 1300 c.c.



## TREATMENT OF CHRONIC EMPYEMA

This patient's general condition was so poor at time of admission that it was necessary to build him up before he could withstand even a fractional type of operation. This was accomplished by stomachics and a high caloric diet; egg-nogs at least three times daily. Cold abscess was injected with iodoform emulsion and strapped. Cavity given active Dakinization.

*Surgical Treatment, Fractional Procedure.*—October 29, 1920. Operation.—Resection of necrotic rib stumps, fourth, fifth and sixth and removal of unhealthy granulations, with mobilization of lung about fistula. Deep alcohol injection of nerves from posterior horn cells. Cavity left open for active Dakinization. (Fig. 37.)

February 4, 1921. Resection of 15 cm. of third, fourth, fifth and sixth ribs, anterior chest, one inch from costochondral junction; excision of thickened parietal pleura and dissection of visceral pleura to allow lung expansion. Skin inserted over severed superficial muscles and fixed. Cavity left open for the continuation of active Dakinization.

April 13, 1921. Operation.—Resection of a portion of ninth and tenth ribs, posterior axillary line, and resection of regenerated portion of sixth and seventh ribs, anterior axillary line. Dakinization continued.

June 21, 1921. Operation.—Resection of 10 cm. of second, third and fourth ribs, posterior scapular line, right chest. Excision of thickened parietal pleura and exposure of apex of cavity; mobilization of lung about fistula; Dakinization continued; all muscle and skin saved and tucked beneath scapula.

Following this operation, the angle of the scapula made pressure on underlying lung structure, hence patient was dressed with a thin steel rib two inches wide and constructed so as to fit the general contour of the chest. This band was well padded and passed beneath the angle of the scapula (Fig. 38) and was fixed in place

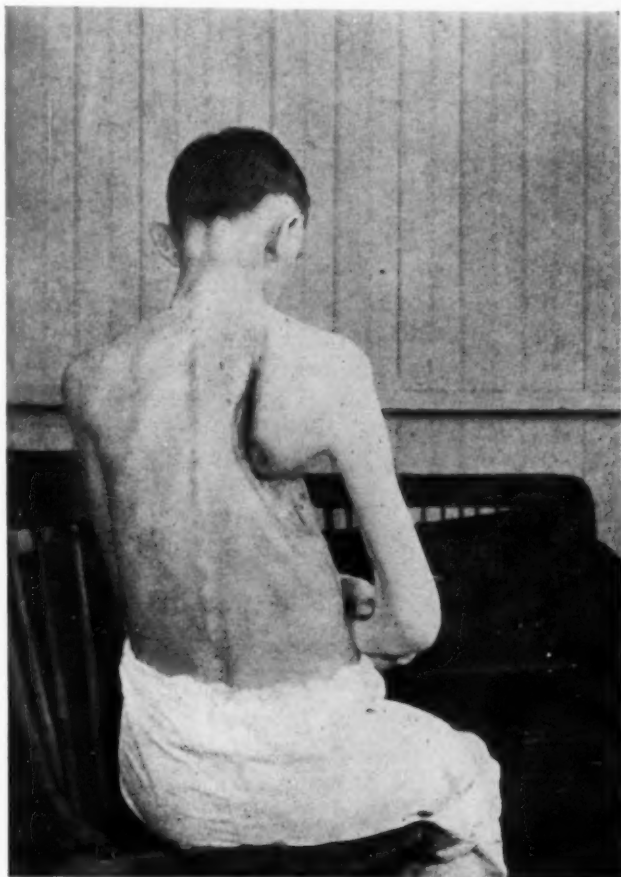


FIG. 36.—Case. XVII. Condition on admission.

by straps over the shoulders and tape across the terminal end of the steel rib on the unaffected side of chest. This held the angle of the scapula away from the underlying lung and still did not interfere with active Dakinization of the cavity.

July 19, 1921. Closure of bronchial fistula by means of mobilization of lung about same and mattress suture. Dakinization continued.

September 13, 1921. Decortication of visceral pleura about fistula that still remains patent and purse-string ligation of same. Dakinization continued.

October 1, 1921. Fistula still patent, although it is considerably smaller. A

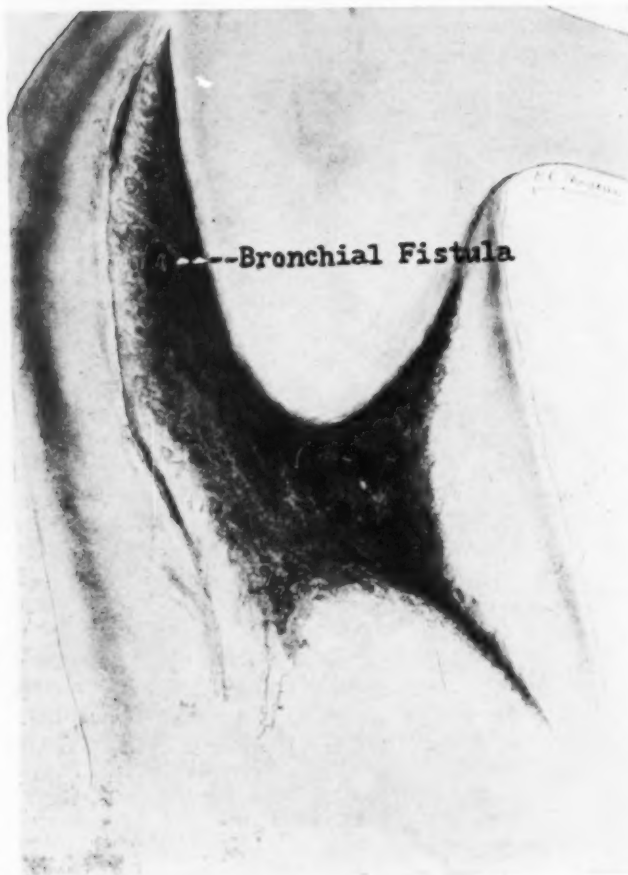


FIG. 37.—Case XVII. Showing situation of bronchial fistula and extent of cavity.

two per cent. alcoholic solution of gentian violet applied and the following day fistula was closed. This was repeated to keep mechanical plug in same until granulations had obliterated tract.

November 15, 1921. The remaining cavity formation in this case consists of a pyramid-like shaped cavity, with its base in the upper aspect of the right chest between three bony structures: clavicle anteriorly, first rib internally and superiorly, and the scapula posteriorly, with the apex of the cavity downward and in the mid-axillary line. It was necessary to devise some method to obliterate this space as maximum amount of lung expansion had been obtained by discission of visceral pleura.

December 1, 1921. Shortening of clavicle to obliterate aforesaid space. Clavicle shortened two inches and fragments mortised and wired in apposition; muscle and skin closed over same. (Fig. 39.)

December 28, 1921. Operation.—Resection of regenerated third and fourth ribs, anterior axillary line, to allow scapula free excursion of motion since clavicle has been shortened and to completely obliterate the space. A portion of the pectoralis major and subscapularis muscles were implanted into apex of space

## TREATMENT OF CHRONIC EMPYEMA

to act as a buffer between the scapula and the underlying lung structures.

Following these operations the angle of scapula was reflected backward and outward, hence device to elevate same from underlying lung tissue was no longer required. Pleurobronchial fistula remains closed, and the cavity is practically sterile.

February 2, 1922. Plastic closure of anterior aspect of wound; muscle and skin and a closure of the upper posterior aspect, muscle and skin with silkworm gut sutures; rubber dam drainage for twenty-four hours. Multiple scarifications of skin to cause relaxation along the suture line and prevent slough. Lower aspect of cavity left open for active Dakinization.

February 27, 1922. Further secondary closure and re-suture of small areas along posterior aspect left open for drainage. Multiple scarifications of skin to cause relaxation of suture line. Lowermost aspect of wound still left open for Dakinization.

March 23, 1922. Additional closure of posterior aspect of wound, muscle and skin, leaving only a small area at lowermost aspect to heal by granulation, this area being so superficial that plastic flap does not seem necessary. However, if required, plastic skin flap will be sutured over area.

March 30, 1922. Wound all but healed. General condition is good; patient has begun to take on weight. Lung expanded; all cavity formation has been obliterated.

June 12, 1922. Sliding flap graft of skin and subcutaneous tissue into unhealed area. Plastic closure remaining structures. Multiple scarification of skin to cause relaxation. Rubber dam drainage for forty-eight hours.

June 26, 1922. Patient all but healed at present time.

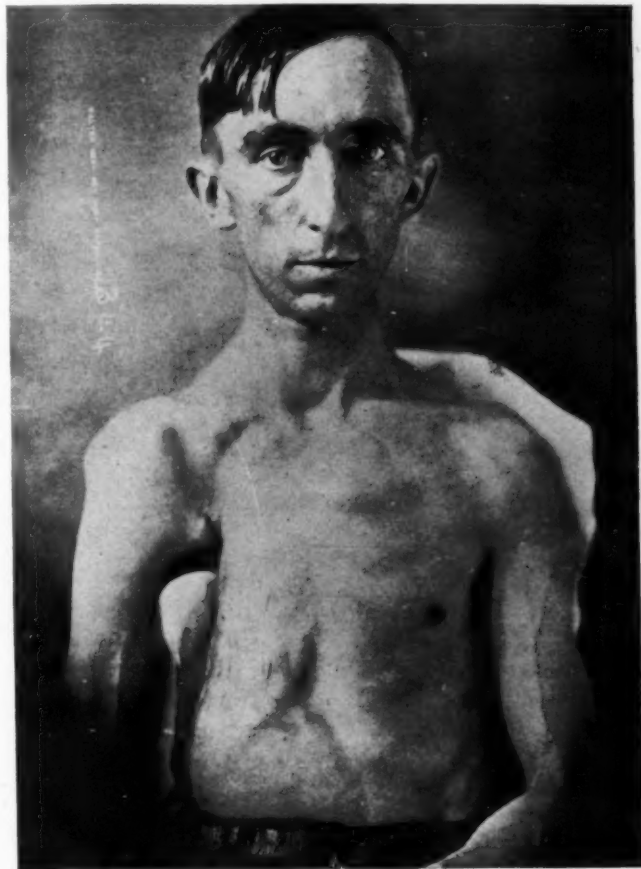


FIG. 38.—Case XVII. Pad to hold angle of scapula away from side of chest.

WILLIAM L. KELLER

Factors to be combated in this case are:

1. Haemolytic streptococcus organism present.
2. Osteomyelitis.
3. Pleurobronchial fistula.
4. Cold abscess and condition of tissues, although sputum has been negative, gives tuberculosis to be reckoned with.
5. Mechanics necessary to obliterate cavity.
6. Patient's general debilitated condition with faulty metabolism; patient only able to withstand a few minutes on table.



FIG. 30.—Case XVII. Showing clavicle shortened two inches.

opened empyema; January 1, 1919, haemolytic streptococcus type

January 15, 1919. Area of previous thoracotomy reopened and drainage instituted with irrigation by Dakin's solution. Treated by this method and reopened a number of times.

Admitted to Empyema Service, June 4, 1921.

Condition on admission. Ambulatory case; fairly well nourished, but showing some anæmia and slightly under weight. Normal weight 150 pounds; present weight 140 pounds. Fingers clubbed and some oedema of extremities.

Examination of chest revealed sinus discharging pus, seventh interspace, mid-

Patient healed. Will be kept under observation two months.

CASE  
XVIII.—J. K., age twenty-five years, received penetrating gunshot wound right chest, machine-gun bullet, July 18, 1918, in action. July 20, 1918, debridement operation. Was aspirated six times and a serosanguinous fluid withdrawn.

December 13, 1918. Operation.—Exploratory thoracotomy seventh and eighth ribs, mid-axillary line. Bullet removed and wound closed. Numerous aspirations followed. Devel-

## TREATMENT OF CHRONIC EMPYEMA

axillary line, right chest, with a large cavity formation partially filled with pus. Radiographs showed marked collapse of right lung with extensive thickening of the parietal pleura, right lateral chest from apex to base and a cavity formation extending from the second to the tenth ribs with a capacity of 600 c.c. and osteomyelitis of rib stumps which had been previously resected. (Fig. 40.)

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; white blood-cells, 12,600; red blood-cells, 4,560,000; urine negative; culture from cavity shows hæmolytic streptococci. Blood-pressure: systolic, 115; diastolic, 70; pulse-pressure, 45; vital capacity reading, 1600 c.c.

*Surgical Treatment, Fractional Procedure.*—June 9, 1921. Resection of 10 cm. of sixth, seventh and eighth ribs, mid-axillary line, right chest: excision of thickened parietal pleura forming roof of cavity; skin inverted over muscles that were severed and same fixed over rib stumps to prevent retraction and preserve same for final closure. Cavity left wide open for active Dakinization. (Fig. 41.)

June 30, 1921. Resection of sixth, seventh, eighth and ninth ribs, 10 cm. posterior scapular line; excision of thickened parietal pleura en masse; skin fixed over severed muscles; cavity left wide open for active Dakinization.

July 25, 1921. Resection of 10 cm. of fourth and fifth ribs, posterior scapular line; cavity left wide open and active Dakinization continued.

November 2, 1921. Resection of 15 cm. of sixth, seventh, eighth and ninth ribs, anterior axillary line; removal of roof of cavity; active Dakinization continued.

October 3, 1921. Resection of 20 cm. of eighth, ninth and tenth ribs; removal of roof of cavity; discission of visceral pleura and Dakinization continued.

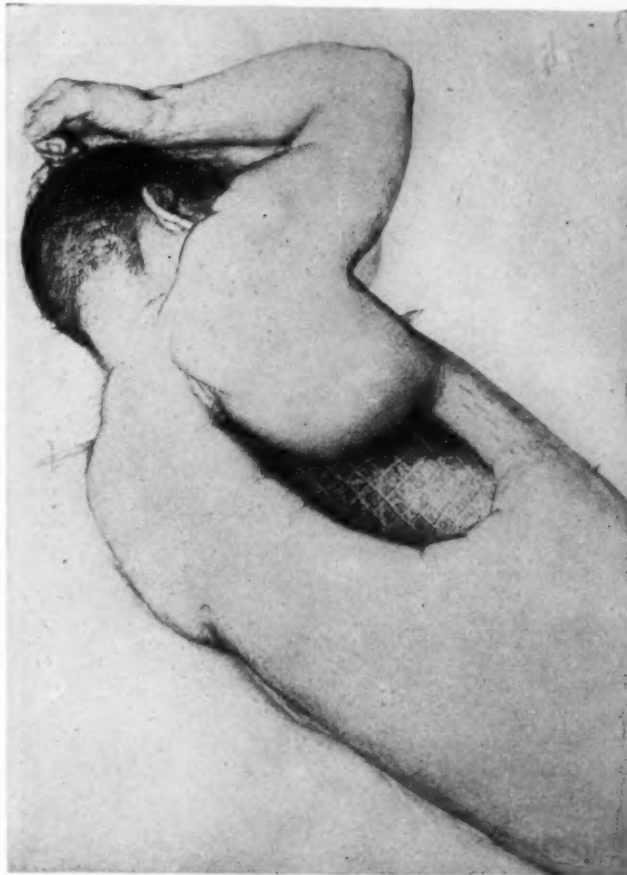


FIG. 40.—Case XVIII. Condition on admission.



WILLIAM L. KELLER

February 27, 1922. Resection of 20 cm. of fourth and fifth ribs anterior axillary line; removal of necrosed sixth and seventh rib stumps, same line and resection of 10 cm. of third rib posterior scapular line. Active Dakinization continued.

March 9, 1922. Secondary closure of upper aspect of cavity, muscle and skin, with the implantation of a portion of the infraspinatus muscle into apex of cavity; severed superficial muscles which have been saved brought in apposition and sutured. Excision of all scar formation and skin closed by silkworm

gut suture. Rubber dam drainage along suture line; discission of entire visceral pleura before closure, and lower aspect of cavity left open for active Dakinization.

May 11, 1922. Plastic closure, partial, of empyema cavity, right chest; muscle and skin, with implantation of superficial muscle body into remaining space after maximum lung expansion had been obtained. Skin and muscle brought in apposition by means of silkworm gut. Multiple scarification of the skin to cause relaxation and rubber

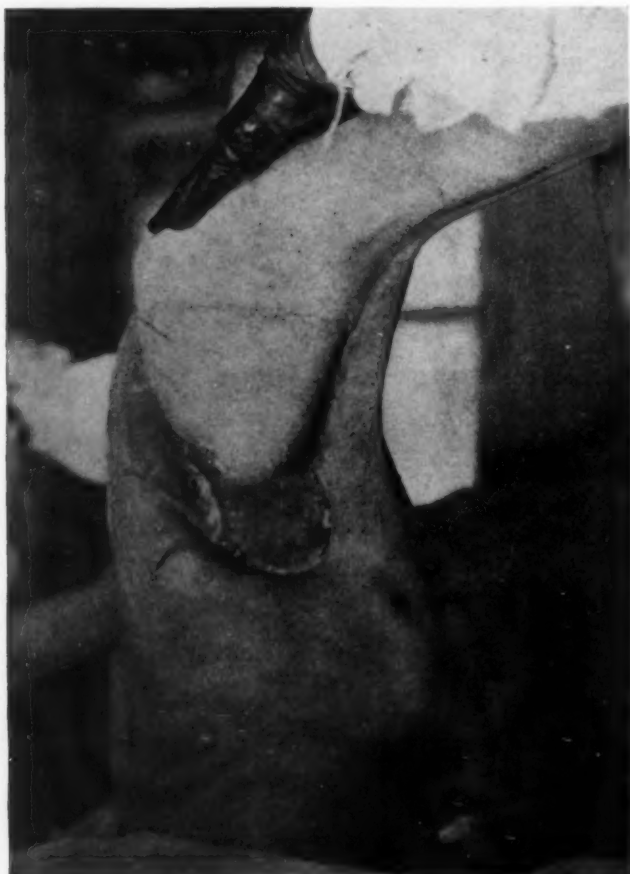


FIG. 41.—Case XVIII. Showing extent and result of primary operation.

ber dam drainage used for forty-eight hours. (Fig. 42.)

June 28, 1922. Plastic closure, muscle and skin, posterior aspect of cavity; muscle and skin brought in apposition and sutured by means of silkworm gut; rubber dam drainage for forty-eight hours; multiple scarification of skin to cause relaxation. Patient will be kept under observation for a period of two months. (Fig. 43.)

Factors to be combated in this case are:

1. Hemolytic streptococcus organisms present.
2. Osteomyelitis of ribs.
3. Diverticulæ or secondary cavities.
4. Constitution psychopath.
5. Myocarditis, chronic.

## TREATMENT OF CHRONIC EMPYEMA

Patient healed; will be kept under observation two months prior to disposition.

CASE XX.—H. S. J., aged twenty-six years, developed influenza and pneumonia, January 10, 1918, complicated by empyema, right pleural cavity, hæmolytic streptococcus type, January 20, 1918. Aspirated twice.

January 24, 1918. Thoracotomy with resection of portion of seventh rib, mid-axillary line, with the institution of drainage for five months without irrigation, followed by irrigation with Dakin's solution for two weeks.

June 19, 1918. Additional rib resection; institution of better drainage.

November 11, 1918. Resection of portion of eighth and ninth ribs to allow better drainage and daily irrigation with Dakin's solution.



FIG. 42.—Case XVIII. Taken at the time of partial closure.

February 19, 1920. Resection of sixth, seventh, eighth and ninth ribs, right chest, mid-axillary line; partial decortication of visceral pleura. Removal of portion of thickened parietal pleura; cavity closed; rubber tube drain.

June 3, 1920. Cavity reopened and further decortication was done in an attempt to obliterate cavity, lower aspect being left open for Dakinization.

Admitted to Empyema Service, November 10, 1920.

Condition on admission: Ambulatory case; anæmic, highly septic, poorly nourished and considerably under weight; normal weight 145 pounds; present weight 111 pounds; fingers clubbed; extremities œdematous. Examination of chest reveals sinus discharging pus, posterior axillary line, marked deformity of contour of right chest, due to previous operations. Radiograph shows marked collapse of right lung with extensive thickening of pleura from apex to base and a bismuth-filled cavity, extending from second rib to mid-axillary line, with multiple diverticuli, draining into main cavity. Capacity of cavity 200 c.c. Pleurobronchial fistula present, the communication being almost direct to the hilus of the lung. Osteomyelitis of rib stumps present.

WILLIAM L. KELLER

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; white blood-cells, 12,600; red blood-cells, 3,750,000; urine showed trace of albumin; culture from cavity showed heavy growth of hæmolytic streptococcus. Blood-pressure: systolic, 110; diastolic, 80; pulse-pressure, 30; vital capacity reading, 1500 c.c.

*Surgical Treatment, Fractional Procedure.*—November 17, 1920. Resection of fifth, sixth, seventh and eighth ribs, posterior scapular line, right chest; excision of thickened parietal pleura and scar tissue; cavity laid wide open; multiple

diverticulum noted and roofs of same excised. Preparation of cavity for active Dakinization. (Fig. 44.)

December 6, 1920. Resection of 10 cm. of third, fourth and fifth ribs; cavity laid wide open; Dakinization continued.

January 12, 1921. Excision of another diverticulum or sinus tract draining into main cavity; Dakinization continued.

March 31, 1921. Excision of old scar, lower aspect of cavity, and an additional portion of the eighth rib resected which had become osteomyelitic.

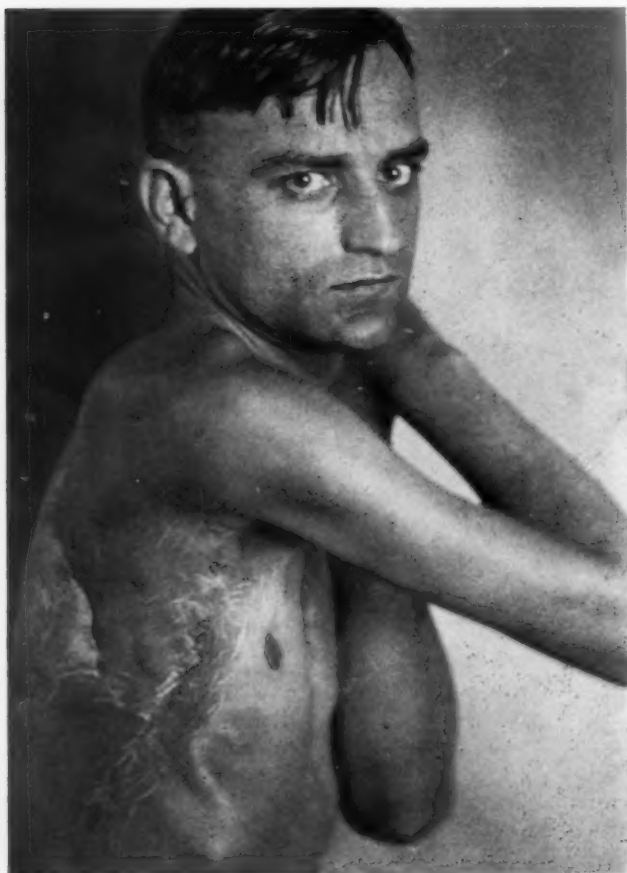


FIG. 43.—Case XVIII. Final result. Posterior shadow is not an opening.

May 17, 1921. Incision anterior axillary line; resection of parts of fifth, sixth and seventh ribs. Three additional sinus tracts found and excised; active Dakinization continued.

June 23, 1921. Resection of third and fourth ribs, anterior axillary line; removal of roof of cavity; dakinization continued; discission of visceral pleura and mobilization of lung about bronchial fistula.

July 27, 1921. Incision along old posterior scar, apex of cavity exposed posteriorly; Dakinization continued.

October 3, 1921. Resection of 5 cm. of third rib, posterior scapular line; excision of the thickened parietal pleura. Discission of the visceral pleura

## TREATMENT OF CHRONIC EMPYEMA

and mobilization of the lung about the bronchial fistula; active Dakinization was continued.

January 12, 1922. Resection of regenerated stumps of third, fourth and fifth ribs, anterior to posterior axillary line. Portion of subscapularis muscle implanted over fistula after lung had been mobilized about same. Anterior aspect of cavity closed; superficial muscle brought in apposition and sutured; skin closed by means of silkworm gut. Multiple scarification of skin to cause relaxation. Posterior aspect of cavity left open for dakinization.

March 3, 1922. Secondary closure with implantation of portion of latissimus dorsi into remaining cavity which was not obliterated by lung expansion, fistula having remained closed following last operation and cavity sterile. Superficial muscles brought in apposition and sutured; skin closed by means of silkworm gut; rubber dam drainage for twenty-four hours; multiple scarification of skin to cause relaxation. (Fig. 45.)

April 1, 1922. Patient improving, but has small area of tenth rib showing osteomyelitis, which will require resection at a future date.

May 5, 1922. Operation.—Resection of 10 cm. of tenth rib, posterior axillary line, right chest and excision of sinus tract leading down to same. Entire area left wide open for active Dakinization.

June 26, 1922. Patient entirely healed, fistula closed; all cavity formation obliterated; lung well expanded; general condition excellent; weight on admission was 111 pounds; present weight is 122 pounds; vital capacity reading, 2200 c.c. (Fig. 46.)

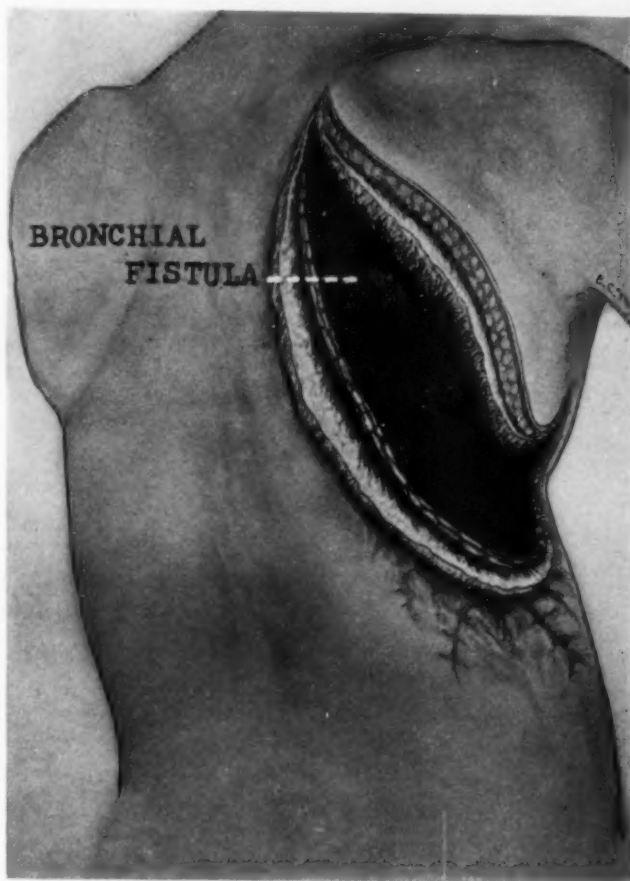


FIG. 44.—Case XX. Showing situation of bronchial fistula, and extent of defect.

WILLIAM L. KELLER

Factors to be combated in this case are:

1. Hæmolytic streptococcus infection.
2. Osteomyelitis of rib stumps.
3. Secondary cavities and diverticulæ.
4. Pleurobronchial fistula.
5. Marked bridging and overlapping of regenerated rib formation.

June 26, 1922. Patient ready for discharge.

CASE XXI.—R. H. S., age thirty years, received a gunshot wound left chest,

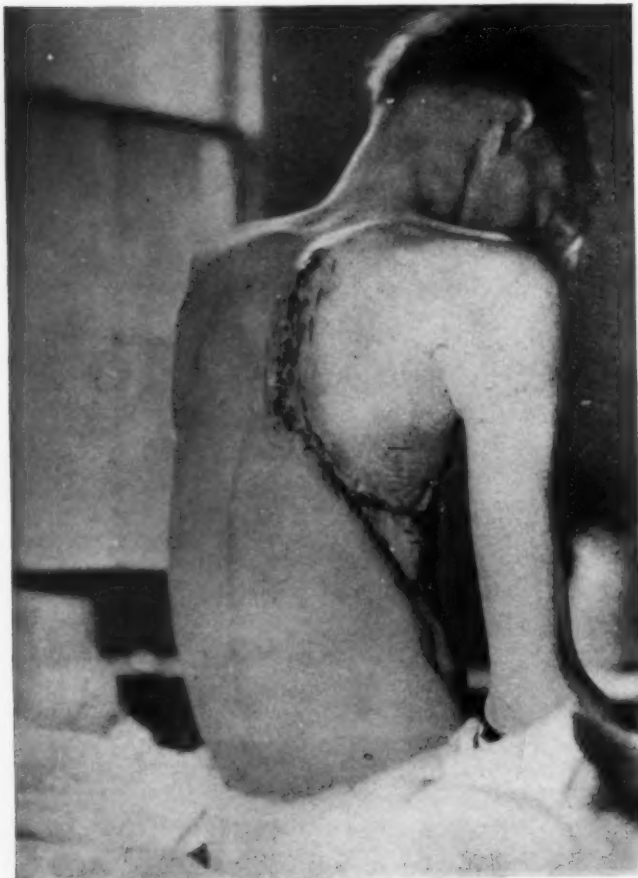


FIG. 45.—Case XX. Result of secondary closure after muscle implantation.

draining; has been reopened for the institution of drainage twelve times.

Admitted to the Empyema Service, Walter Reed General Hospital, January 26, 1922.

Condition on admission: Ambulatory case, fairly well nourished, but considerably under weight; normal weight 165 pounds; present weight 145 pounds.

Examination of chest: Sinus discharging pus, eighth interspace, mid-scapular line, left chest; drainage not dependent. Radiographs showed marked collapse of left lung with a cavity formation extending from the fourth to the ninth rib with a capacity of 500 c.c. Heart considerably displaced to the right and marked thickening of the parietal pleura, left lateral chest, from second rib to base.

penetrating sixth interspace nipple line, in action, November 1, 1918; developed influenza November 4, 1918, which was complicated by pneumonia, November 10, 1918, and this was complicated by empyema, left pleural cavity, hæmolytic streptococcus type, November 17, 1918. Aspirated four times.

November 15, 1918. Operation, Thoracotomy. — Resection of a portion of the eighth rib, mid-scapular line, with the institution of drainage.

March 22, 1919. Discharged from the service still



## TREATMENT OF CHRONIC EMPYEMA

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; white blood-cells, 8050; red blood-cells, 4,810,000; urine negative; culture from cavity shows hæmolytic streptococcus and staphylococcus aureus. Blood-pressure: systolic, 106; diastolic, 74; pulse-pressure, 32; vital capacity reading, 2000 c.c.

*Surgical Treatment, Fractional Procedure.*—January 31, 1922. Operation.—Resection of 15 cm. seventh, eighth and ninth ribs, mid-scapular line, left chest; excision of thickened parietal pleura forming roof of cavity; skin inverted over severed muscles and fixed over resected rib stumps to render dressings less painful and preserve structures for future closure, multiple scarifications of skin to cause relaxation; preparation of cavity for active Dakinization. (Fig. 47.)

February 13, 1922. Operation.—Resection of 15 cm. of fourth, fifth and sixth ribs, posterior axillary line, left chest; removal of thickened parietal pleura forming roof of cavity; discission of visceral pleura to allow lung expansion; skin inverted over muscles that were cut and preserved for future closure; entire cavity left open for active Dakinization.

March 8, 1922. Cavity is now one-fourth its original size and the lung is still expanding; bacterial examination shows only a few colonies of staphylococcus aureus. We will soon be ready for further operative procedure.

April 5, 1922. Plastic closure muscle and skin with the implantation of a portion of the latissimus dorsi into remaining space after maximum lung expansion had been obtained. Skin and superficial muscles brought into apposition and sutured with silkworm gut. Scarification of skin to cause relaxation; rubber dam and tube drainage for twenty-four hours.

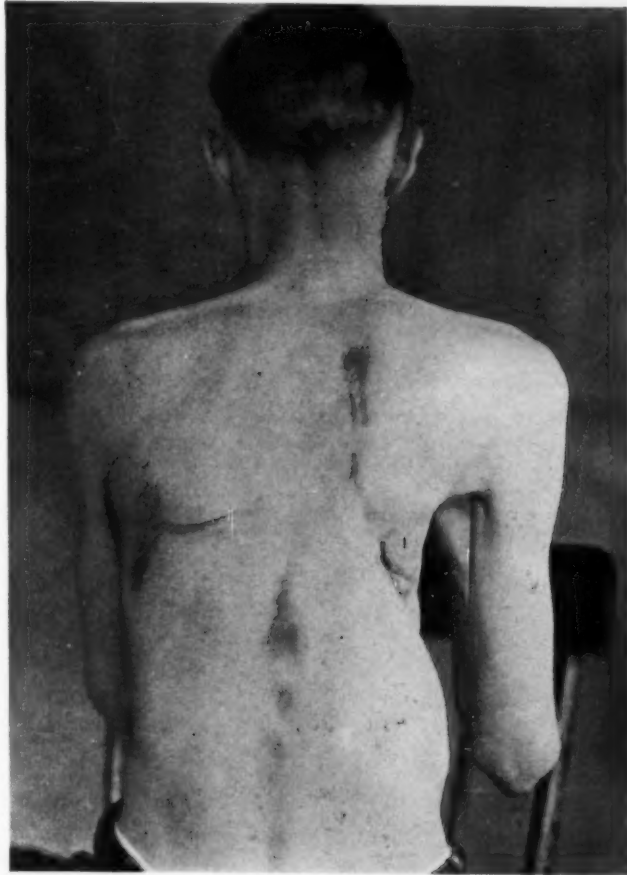


FIG. 46.—Case XX. Final result.



FIG. 48.—Case XXI. Final result.



FIG. 47.—Case XXI. Showing one stage of obliterative process.

## TREATMENT OF CHRONIC EMPYEMA

May 1, 1922. Patient entirely healed; condition excellent. Taken on weight since first operation. Lung well expanded. All cavity formation obliterated.

June 12, 1922. Healed; condition excellent; 165 pounds; vital capacity, 3400 c.c. (Fig. 48.)

Factors to be combated in this case are:

1. Hemolytic streptococcus organism present.
2. Osteomyelitis with rib sequestration.
3. Secondary cavity.

Discharged cured, June 12, 1922.

CASE XXIII.—C. J. W., age twenty-seven years, developed pneumonia, January 5, 1918; complicated by empyema, right pleural cavity, hemolytic streptococcus type. January 12, 1918, aspirated eight times.

January 22, 1918. Thoracotomy—resection of 10 cm. of eighth rib, posterior axillary line, right chest. Rubber tube valve inserted for drainage and Carrel tubes used to instill Dakin's solution.

Remained under treatment by this method until May 15, 1919, when he was discharged from the service with an open sinus still discharging pus.

Returned to his home and remained there under treatment by a private physician; chest reopened nine times to institute drainage of accumulation of pus,

Admitted to Empyema Service, August 11, 1921.

Condition on admission: Ambulatory case, poorly nourished and considerably under weight; normal weight 162 pounds; present weight 123 pounds. Examination of chest revealed sinus discharging pus eighth interspace, posterior axillary line, right chest. Radiographs showed marked collapse of right lung with extensive thickening of pleura, lateral chest from second rib to base, and a cavity formation noted from fourth to tenth rib. A piece of rubber tubing  $2\frac{1}{2}$  inches in length observed in the lower aspect of cavity. Pleurobronchial fistula present and the capacity of cavity 400 c.c. Osteomyelitis with sequestration of the eighth and ninth ribs with fusion and overlapping of same present. (Fig. 49.)

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; W.B.C., 9200; R.B.C., 4,500,000; urine showed trace of albumin; culture from cavity showed heavy growth of hemolytic streptococci. Blood-pressure: systolic, 142; diastolic, 84; pulse-pressure, 58; vital capacity reading, 1800 c.c.

*Surgical Treatment, Fractional Procedure.*—October 12, 1921. Operation.—Resection of seventh, eighth and ninth ribs, 15 cm. posterior axillary line, right chest; cavity laid wide open and thickened parietal pleura excised; removal of Carrel valve or rubber tube which had been in cavity over two years; discission of visceral pleura to allow lung expansion; skin inverted over muscles to preserve same for final closure and to render dressings less painful; preparation of cavity for Carrel-Dakin technic for sterilization of same.

October 31, 1921. Operation.—Resection of anterior portion of seventh rib and part of costal cartilage, with a resection of 15 cm. of eighth rib, right chest, anterior axillary line, and the removal of overlying thickened pleura exposing secondary cavity; skin and muscle preserved for future closure; discission of visceral pleura to allow lung expansion.

November 30, 1921. Operation.—Resection of 20 cm. of fifth, sixth and seventh ribs, posterior scapular line, right chest, and resection of 5 cm. of eighth, ninth and tenth ribs, with removal of thickened pleura forming roof of secondary cavity which had been sterilized, discission of visceral pleura exposed and implantation of a portion of the latissimus dorsi and subscapularis muscles into upper aspect of cavity; muscle and skin closure over this area.

January 6, 1922. Operation.—Resection of ninth, tenth and eleventh ribs, 10 cm., and excision of two sinus tracts, one following course of tenth rib and the

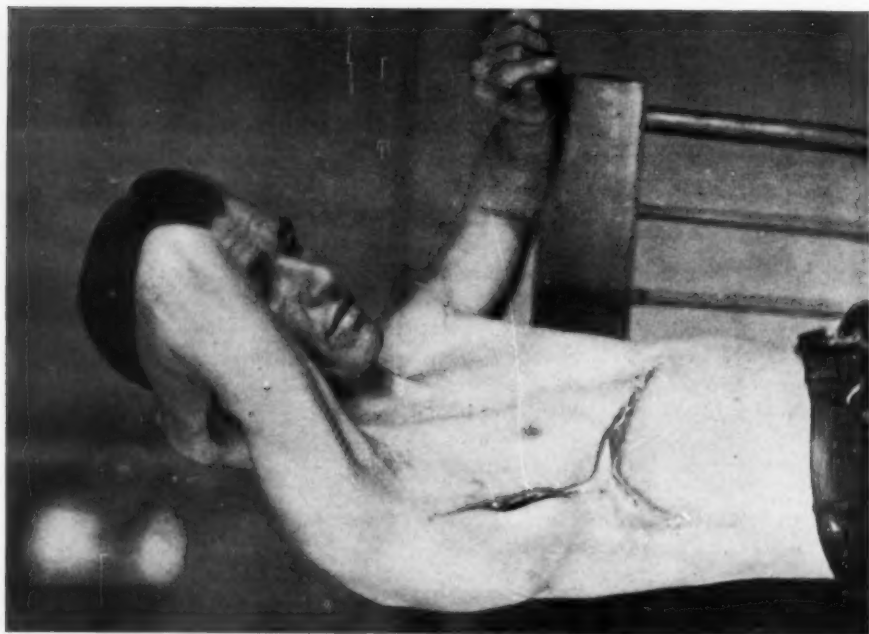


FIG. 50.—Case XXIII. Showing five subcavities; three posterior cavities obliterated; two anterior cavities still open but obliterating.

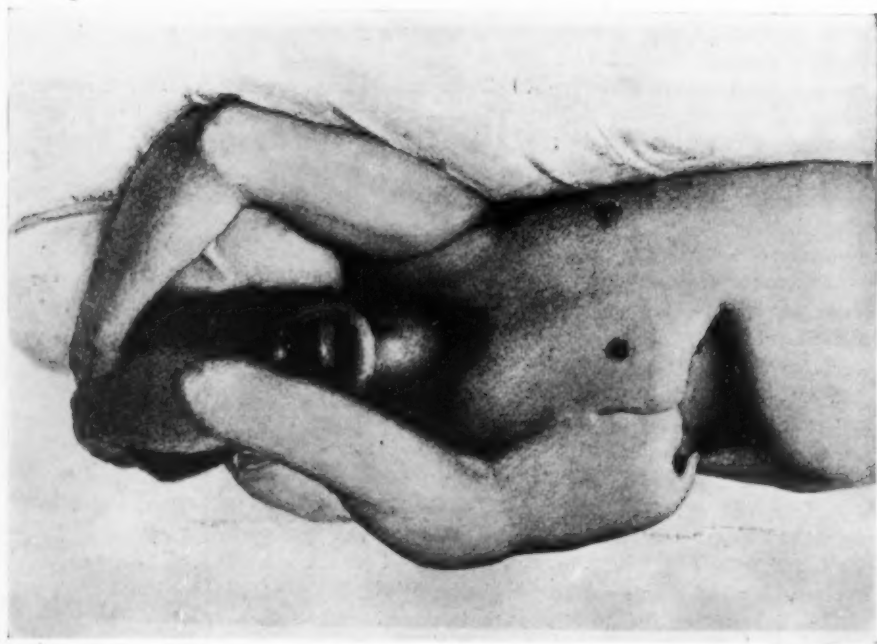


FIG. 49.—Case XXIII. Condition on admission.

## TREATMENT OF CHRONIC EMPYEMA

other leading down to twelfth rib, mid-axillary line, right chest. Skin inverted over the muscle, which was saved for future closure; area left open for active Dakinization.

February 6, 1922. Operation.—Resection of fourth, fifth and sixth ribs, 10 cm. anterior axillary line, right chest, with the removal of the roof of another secondary cavity and the preparation of same for active dakinization.

April 5, 1922. Partial plastic closure muscle and skin, with the implantation of portion of the superficial muscles into the upper aspect of the cavity, mid-axillary line, with injection of iodoform emulsion into same before area was closed. Lower anterior portion of secondary cavity likewise closed with the emulsion injection and skin and muscle brought in apposition and sutured with silkworm gut; multiple scarification of skin to cause relaxation; rubber dam drainage for forty-eight hours. (Fig. 50.)

June 26, 1922. Patient healed; fistula closed; all cavity formation obliterated; lung was well expanded; the general condition excel-



FIG. 51.—Case XXIII. Final result.

lent. Patient had taken on some weight; vital capacity reading, 2500 c.c.

Factors to be combated in this case are:

1. Hemolytic streptococcus organism present.
2. Carrel valve rubber drainage tube left in cavity.
3. Osteomyelitis with rib sequestration.
4. Pleurobronchial fistula.
5. Secondary cavity and diverticulæ—five in number.
6. Nephritis, chronic, interstitial.
7. Tuberculosis, supported by pathological specimen.
8. Chondritis of sixth, seventh and eighth costal cartilage.



WILLIAM L. KELLER

Patient cured and ready for discharge upon his return from thirty-day leave.

CASE XXVI.—J. W. W., age twenty-seven years, developed influenza, May 16, 1918, complicated by empyema, left pleural cavity, hæmolytic streptococcus type, June 8, 1918; aspirated once.

June 10, 1918. Operation.—Thoracotomy; resection of 10 cm. of seventh rib, anterior axillary line, left chest; pleural cavity opened and 500 c.c. of pus evacuated; rubber tube valves inserted into cavity for drainage.

October 5, 1918. Operation.—Thoracotomy. Resection of a portion of the proximal end of the seventh rib, left chest, and the institution of drainage.

January 12, 1919. Incision with institution of drainage.

September 17, 1919. Resection of a portion of the seventh rib and regenerated bone and drainage again instituted with a Dakin solution irrigation. Discharged from service February, 1920, and taken over as a Public Health patient, being treated in a number of hospitals, and was sent to Mt. Alto, Pennsylvania, for treatment of suspected tuberculosis.

Admitted to Empyema Service, December 5, 1921.

Condition on admission: Ambulatory case; poorly nourished and considerably under weight; normal weight 165 pounds; present weight 148 pounds; joints of extremities œdematous and tender; persistent cough with the expectoration of frank pus; highly septic; fingers clubbed.

Examination of chest revealed marked lagging of left side on deep inspiration; scar formation over seventh rib from the anterior to the posterior axillary line. (Fig. 52.) Percussion revealed impaired resonance to flat note from second rib to base of left chest; auscultation breath sounds distant and indistinct.

Radiographs showed marked collapse of left lung, with extensive thickening of pleura, left lateral chest, from second rib to base, and a large cavity formation filled with fluid and extending from fourth rib, posterior chest, down to ninth rib. Marked displacement of heart to the right. Pleurobronchial fistula present and patient was partially able to drain his cavity by lowering his head and coughing.

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; white blood-cells, 12,700; red blood-cells, 4,200,000; urine negative; culture from cavity showed heavy growth of hæmolytic streptococcus. Blood-pressure: systolic, 122; diastolic, 80; pulse-pressure, 42; vital capacity reading, 2000 c.c.

*Surgical Treatment, Fractional Procedure.*—December 14, 1921. Operation.—Resection of sixth, seventh, eighth and ninth ribs, 20 cm. posterior axillary line, left chest; cavity laid wide open and the evacuation of 500 c.c. of pus; the thickened parietal pleura forming roof of cavity excised. Dissection of the visceral pleura to allow lung expansion and to mobilize the lung about fistula; skin inverted over muscle to preserve same for final closure and preparation of cavity for the Carrel-Dakin technic for sterilization of same.

January 5, 1922. Dissection of visceral pleura and the treatment of fistula with a two per cent. alcoholic solution of gentian violet to mechanically plug the same until granulations entirely obliterate communication.

February 20, 1922. Cavity entirely obliterated, pleurobronchial fistula closed, and wound sterile by seven consecutive daily cultures.

February 24, 1922. Operation.—Secondary closure, partial upper and posterior aspect of wound closed—muscle and skin with silkworm gut and rubber dam drainage.

March 8, 1922. Operation.—Secondary closure, lower aspect of wound, all scar tissue removed, and muscle and skin brought in apposition and sutured. Rubber dam drainage and multiple scarification of skin to cause relaxation and relieve tension.

## TREATMENT OF CHRONIC EMPYEMA

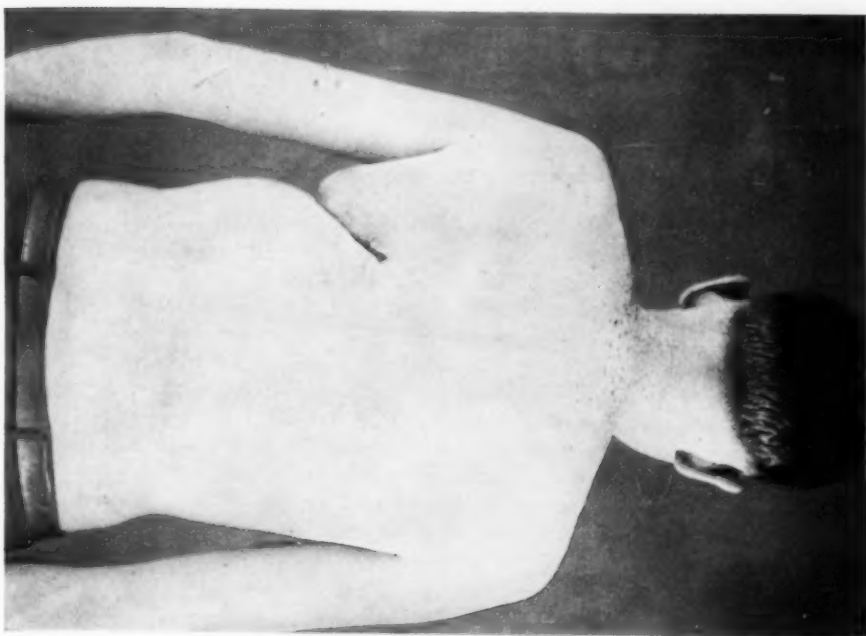


FIG. 52.—Case XXVI. Condition on admission.

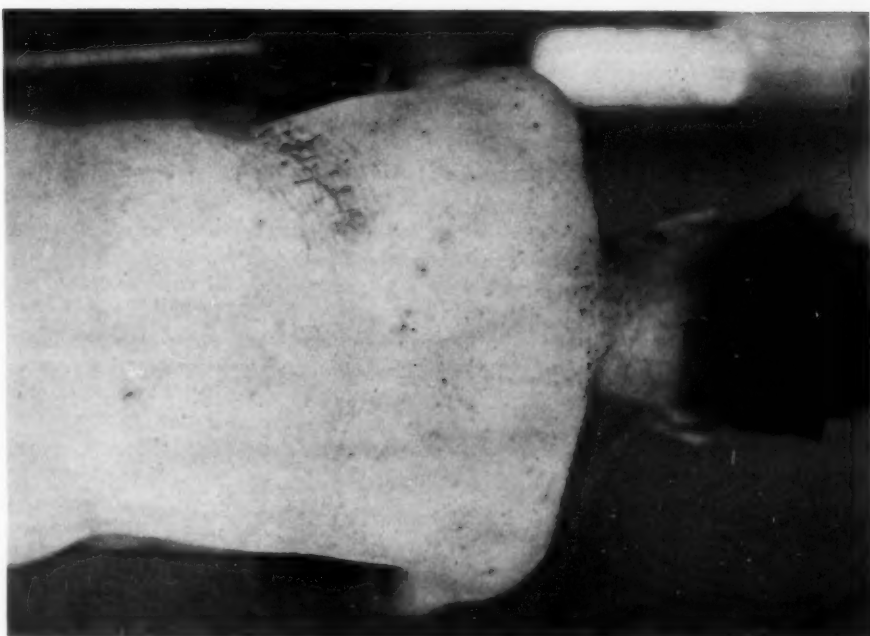


FIG. 53.—Case XXVI. Final result.

WILLIAM L. KELLER

March 20, 1922. Patient entirely healed; condition excellent. Weight on admission 148 pounds; weight at present 170 pounds; vital capacity reading, 3200 c.c. (Fig. 53.)

Factors to be combated in this case are:

1. Haemolytic streptococcus organism present.
2. Pleurobronchial fistula present.
3. Osteomyelitis with sequestration of rib.

June 15, 1922. Patient entirely cured; healed two months; condition excellent; patient discharged.

CASE XXVIII.—R. F. L., age twenty-eight years, was gassed in action in Argonne Forest (patient's statement), October 13, 1918, and was treated in hospital until December, 1918. Discharged from service, February 27, 1919. Developed influenza and pneumonia, March 1, 1919, complicated by empyema, left pleural cavity, haemolytic streptococcus type, March 20, 1919; aspirated twice.

Operation March 28, 1919. Thoracotomy; resection of a portion of the eighth rib, posterior axillary line, with the institution of drainage.

June 8, 1920. Thoracotomy; resection of a portion of the seventh rib, posterior axillary line, and the removal of regenerated eighth rib in the area of operation with the institution of drainage.

October 29, 1920. Operation.—Resection of an additional portion of the anterior stumps of the seventh and eighth ribs, with the institution of drainage.

Patient states that he was reopened to institute drainage eleven times in addition to the above operations.

Admitted to Empyema Service, January 20, 1922.

Condition on admission: Ambulatory case; poorly nourished and considerably under weight; normal weight 140 pounds; present weight 117 pounds. Extremities oedematous and patient showing the facies of sepsis. Fingers clubbed and marked anaemia present. Examination of chest revealed sinus discharging pus, seventh interspace, posterior axillary line, left chest; pleurobronchial fistula present.

Radiographs showed marked collapse of left lung; extensive thickening of the parietal pleura from apex to base left lateral chest and a large cavity partially filled with pus extending from third rib to ninth rib, with a capacity of 450 c.c., the upper aspect of same only communicating with the main cavity by means of a small sinus.

Bacteriological examination: Wassermann plus minus, had been double plus and had received two courses of antisyphilitic treatment. Sputum negative for tubercle bacilli. White blood-cells, 18,550; red blood-cells, 4,130,000; urine showed trace of albumin; culture from cavity showed haemolytic streptococci. Blood-pressure: systolic, 110; diastolic, 74; pulse-pressure, 36; vital capacity reading, 1700 c.c.

*Surgical Treatment, Fractional Procedure.*—January 23, 1922. Operation.—Resection of 20 cm. of sixth, seventh, eighth and ninth ribs, posterior axillary line, left chest; removal of thickened parietal pleura and the excision of thick bands of fibrous tissue dividing the main cavity into three subcavities; the fistula exposed and the skin inverted over the severed muscles; cavity left open for active Dakinization.

February 23, 1922. Operation.—Resection of 20 cm. of fourth and fifth ribs and 5 cm. of the posterior stumps of the sixth and seventh ribs; excision of parietal pleura forming roof of secondary cavity; discission of visceral pleura to allow expansion; cavity left wide open for active Dakinization; skin inverted over severed muscles and fixed over rib ends to prevent retraction and to render dressing less painful, with multiple scarifications of skin to relieve tension.

March 8, 1922. Fistula closed by means of repeated applications of a two per

## TREATMENT OF CHRONIC EMPYEMA

cent. alcoholic solution of gentian violet; cavity cleaning up; patient's general condition greatly improved; all œdema has disappeared from extremities; will soon be ready for further operative procedure.

March 23, 1922. Resection of 10 cm. of third and fourth ribs, posterior scapular line; removal of roof of secondary cavity and remaining sinus injected with iodoform emulsion; muscle implantation into apex of cavity to obliterate the remaining space, and continuation of the active Dakinization of the entire cavity.

June 9, 1922. Resection of a portion of second, third, fourth, fifth and sixth ribs, posterior scapular line, left chest; excision of thickened parietal pleura forming roof of cavity; entire secondary cavity exposed and complete area left open for active Dakinization.

June 26, 1922. Patient on active Dakinization; entire cavity wide open. Bacterial count shows several no-growth cultures. All œdema of feet and ankles has cleared up. General condition greatly improved.

This patient has been undergoing vigorous syphilitic treatment and for that reason the cavity has been left open.

Factors to be combated in this case are:

1. Hæmolytic streptococcus organism present.
2. Thickened pleura.
3. Faulty drainage.
4. Scoliosis.
5. Accessory cavity.

CASE XXXI.—W. R., age twenty-eight years, developed pneumonia February 1, 1917, complicated by empyema, right pleural cavity, hæmolytic streptococcus type, February 11, 1917; aspirated three times.

February 14, 1917. Operation.—Thoracotomy with resection of a portion of the ninth rib, posterior axillary line, and the institution of drainage. Patient healed March 6, 1918, and entered the military service May 28, 1918. Remained on active duty without recurrence until June 28, 1919, when he was discharged from the service. July 6, 1919, developed a recurrence of empyema.

July 8, 1919. Operation.—Incision and drainage, and irrigation with Dakin solution daily. Has healed and been reopened at least fifteen times.

Admitted to Empyema Service, March 29, 1922.

Condition on admission: Ambulatory case; well nourished; normal weight, but slightly anæmic and highly septic; weight on admission 180 pounds.

Examination of chest revealed sinus discharging pus, ninth interspace, mid-scapular line, right chest; radiograph showed some collapse of the right lung and extensive thickening of the parietal pleura from apex to base, right lateral chest. Cavity formation extending transversely from seventh to ninth rib with a capacity of 250 c.c.

Bacteriological examination: Wassermann double plus; sputum negative for tubercle bacilli; red blood-cells, 4,110,000; white blood-cells, 10,700; hæmoglobin, 80 per cent.; urine negative; culture from cavity shows hæmolytic streptococci. Blood-pressure: systolic, 130; diastolic, 80; pulse-pressure, 50; vital capacity reading, 2000 c.c.

*Surgical Treatment, Fractional Procedure.*—March 31, 1922. Resection of 20 cm. seventh, eighth and ninth ribs, posterior axillary line, excision of thickened parietal pleura. Entire cavity laid wide open; two diverticulæ draining into main cavity were excised. Implantation of a portion of the serratus magnus into the anterior aspect of the cavity. Skin inverted over superficial muscles and fixed; multiple scarification of skin to cause relaxation; preparation of cavity for active Dakinization. (Fig. 54.)

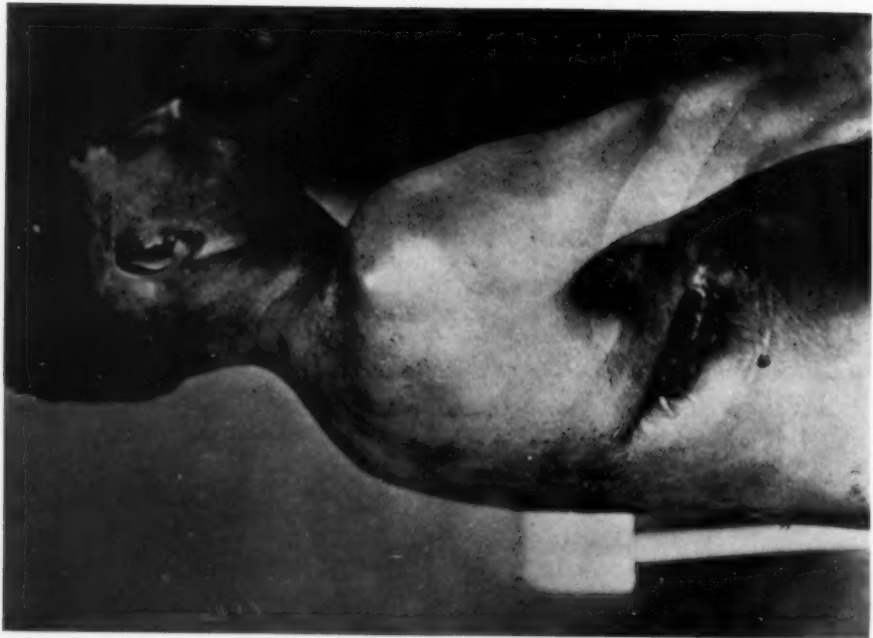


FIG. 54.—Case XXXI. Condition during muscular implantation.



FIG. 55.—Case XXXI. Final result.



## TREATMENT OF CHRONIC EMPYEMA

April 17, 1922. Resection of 10 cm. of the ninth and tenth ribs, mid-axillary line, to remove osteomyelitic involvement. Skin inverted over superficial muscle; entire cavity left wide open for continued Dakinization.

May 31, 1922. Excision of sinus tract draining into main cavity. Removal of a sequestrum or detached particles of rib fragments in area of seventh rib; entire area left open for continued Dakinization.

June 21, 1922. Plastic closure, muscle and skin; implantation of portion of superficial muscle body into remaining space after maximum lung expansion had been obtained; all scar tissue excised; severed muscles and skin brought in apposition by means of silkworm gut sutures; rubber dam drainage for forty-eight hours; multiple scarification of skin to cause relaxation.

June 28, 1922. All sutures removed and area healed by primary intention. (Fig. 55.) Lung is well expanded; general condition is excellent; vital capacity 3400 c.c. This case will be kept under observation for two months before final disposition.

Factors to be combated in this case are:

1. Hæmolytic streptococcus organism present.
2. Osteomyelitis with sequestration.
3. Diverticulæ and numerous sinus tracts draining into remaining cavity.
4. Syphilis, tertiary, manifested by double plus Wassermann.
5. Profuse acne.

CASE XXXVIII.—A. M., age twenty-seven, developed influenza, October 23, 1918, followed by pneumonia, October 27, 1918, and the latter complicated by empyema, left pleural cavity, hæmolytic streptococcus type, November 2, 1918. Four operations prior to admission to this hospital with partial resection eighth and ninth ribs, left side.

Condition on admission: Patient anæmic, considerably under weight—normal weight 168 pounds; present weight 131 pounds; poorly nourished, highly septic.

Examination of chest showed sinus draining pus at the level of the ninth rib, mid-scapular line, left chest.

Radiograph revealed cavity extending from the level of the ninth rib, posterior, to the third rib, posterior, about 4.5 cm. at its widest portion. The cavity is spindle shaped. There has been resection of parts of the eighth and ninth ribs posterior, with regeneration of the bone joining the resected ends. Marked collapse of left lung with thickened pleura from base to apex. Pneumothorax most marked in the upper portion of the left chest. Heart, aorta and mediastinal contents are displaced markedly to the right.

Bacteriological examination: Wassermann negative; urine negative; sputum negative for tubercle bacilli; red blood-cells, 4,000,000; white blood-cells, 7000; hæmoglobin, 85 per cent.; culture from cavity shows streptococcus hæmolyticus.

*Surgical Treatment, Fractional Procedure.*—November 10, 1920. Resection of 20 cm. of the third to sixth ribs, left. The sinus tract was excised and the cavity laid wide open over this area. Preparation for active Dakinization.

December 27, 1920. The lower part of the cavity was attacked and about 20 cm. of the seventh, eighth and ninth ribs were resected. Cross-formation with necrosis was found in this area. This part of the cavity being laid widely open, the whole of the latter was now exposed to view.

The cavity soon cleaned up under active Dakinization. The obliteration of the wound proceeded at a rapid rate. This was aided by linear scarifications of the visceral pleura at weekly intervals. The depth of the wound gradually decreased largely by the reëxpansion of the previously collapsed lung.

April 27, 1921. The cavity had diminished in all dimensions so that its capacity was less than one-fourth its original size. Patient gained in weight and strength. General condition markedly improved.

May 15, 1921. The cavity was entirely obliterated in its lower aspect and the upper angle showed only a superficial wound, the floor of which was formed by the visceral pleura. A plastic operation was contemplated, with excision of the scar tissue and establishing the continuity of the muscle bodies lying on either side of the old wound. However, patient considered himself practically well and requested discharge. Patient discharged June 3, 1921.

Factors to be combated in this case are:

1. Haemolytic streptococcus organism present.
2. Osteomyelitis of rib stumps.
3. Marked collapse of left lung with thickened pleura from apex to base.

CASE XXXIX.—R. L. S., age twenty-one years, developed influenza, February 26, 1920, complicated by bronchopneumonia, March 5, 1920, and later complicated by empyema, left pleural cavity, haemolytic streptococcus type, March 18, 1920; aspirated six times.

March 24, 1920. Operation.—Intercostal thoracotomy, eighth interspace, anterior axillary line, with institution of drainage and irrigation with Dakin's solution.

August 12, 1920. Operation.—Thoracotomy; resection of 10 cm. of seventh and eighth ribs, anterior axillary line, cavity left open for irrigation with Dakin's solution.

Admitted to the Empyema Service of the Walter Reed General Hospital, September 24, 1920.

Condition on admission: Ambulatory case, poorly nourished and considerably under weight; normal weight 130 pounds; present weight 115 pounds.

Examination of chest reveals sinus discharging pus, anterior axillary line, left chest; pleurobronchial fistula present and a large cavity formation extending up to second rib, anterior aspect, left chest. A large cavity formation noted extending from second rib to base, with a capacity of about 500 c.c.

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; white blood-cells, 6250; red blood-cells, 4,700,000; urine negative; culture from cavity showed haemolytic streptococcus and proteus. Blood-pressure: systolic, 132; diastolic, 74; pulse-pressure, 58; vital capacity reading, 1600 c.c.

*Surgical Treatment, Fractional Procedure.*—November 5, 1920. Operation.—Resection of 20 cm. of fourth, fifth, sixth, seventh and eighth ribs, left chest, mid-axillary line, with the roof of cavity excised and pleurobronchial fistula exposed. Skin inverted over muscles that were severed and fixed over rib stumps to preserve same for final closure and render dressing less painful. Cavity left open for active Dakinization. (Fig. 56.)

December 1, 1920. Operation.—Resection of 10 cm. of second and third ribs, anterior axillary line, left chest, with a plastic closure of the upper aspect of cavity with a portion of the pectoralis minor muscle; the severed superficial muscles and skin brought in apposition and sutured. The lower aspect of the cavity was left open for drainage and Dakinization.

December 2, 1920. Operation.—Enlargement of drainage opening in lower aspect of cavity and preparation of same for active Dakinization.

January 31, 1921. Operation.—Resection of 10 cm. of eighth and ninth ribs, anterior axillary line, left chest; bronchial fistula closed by suture and implanting muscle over same; sinus tract excised. (Fig. 57.)

April 28, 1921. Operation.—Mobilization of lung about fistula and closure of fistulous tract by means of purse-string suture, plastic closure of lower aspect of cavity leaving ample drainage.

September 29, 1921. Operation.—Excision of scar and superficial ulcer over lower aspect of plastic closure.

# TREATMENT OF CHRONIC EMPYEMA

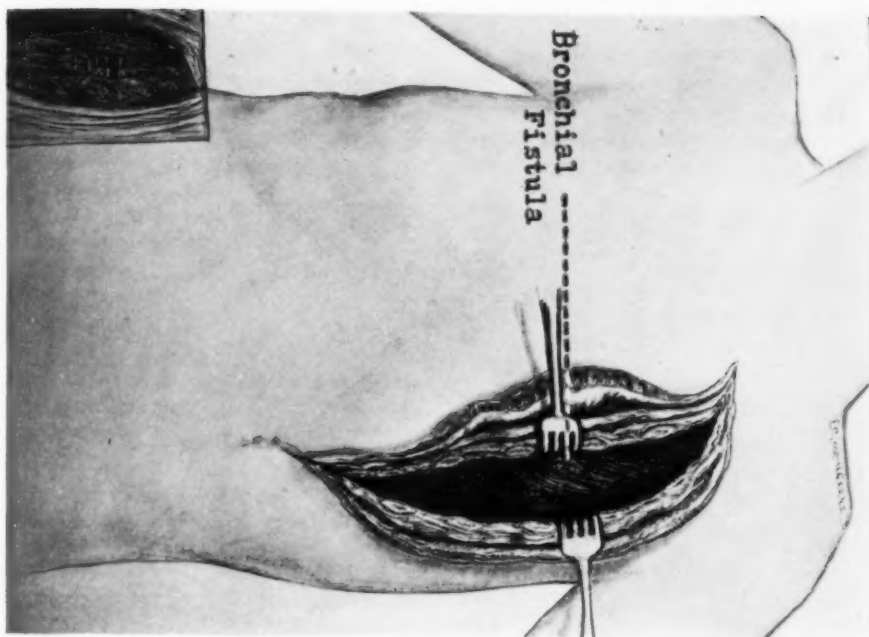


FIG. 56.—Case XXXIX. Showing bronchial fistula and extent of defect.

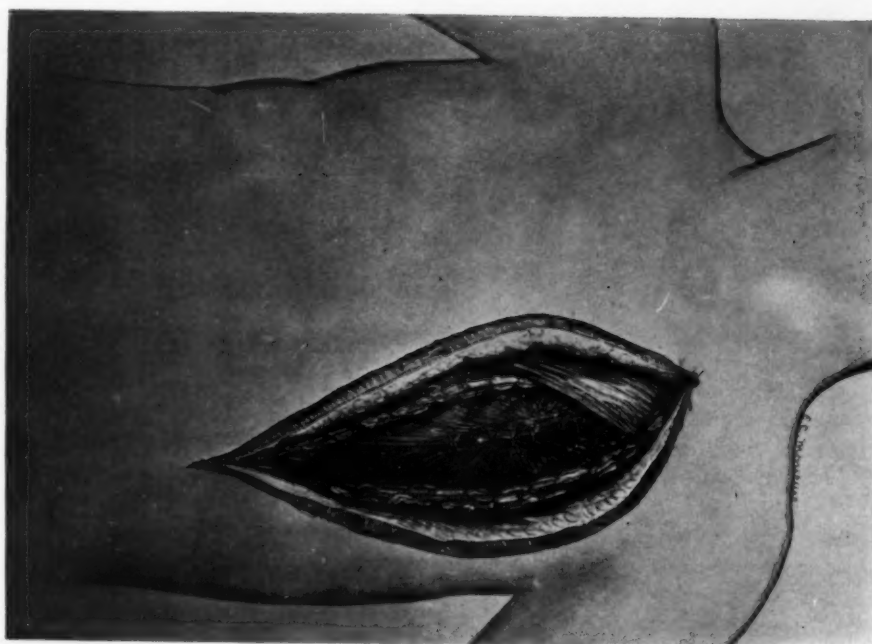


FIG. 57 —Case XXXIX. Fistula closed.

WILLIAM L. KELLER

November 20, 1921. Patient entirely healed, general condition excellent. Has taken on weight since his first operation; X-ray shows total obliteration of all cavity formation and the lung well expanded.

December 6, 1921. Healed and in excellent physical condition. Weight at present is 135 pounds; vital capacity reading, 2300 c.c. Granted sixty-day leave.

March 1, 1922. Condition steadily improving.

May 15, 1922. Discharged completely cured; healed five months. (Fig. 58.)



FIG. 58.—Case XXXIX. Final result.

Factors to be combated in this case are:

1. Hemolytic streptococcus organism present.

2. Osteomyelitis with rib sequestration.

3. Pleuro-bronchial fistula present.

CASE XL.—H. G. C., aged twenty-six years, developed pneumonia, January 25, 1918, complicated by empyema, right pleural cavity, hemolytic streptococcus type, January 27, 1918; aspirated three times.

Received seven operations prior to his admission to this hospital, with resection

of the fifth to tenth rib inclusive, right chest. Received active Dakinization and continuous treatment.

Admitted to Empyema Service, Walter Reed Hospital, March 29, 1922.

Condition on admission: Ambulatory case, fairly well nourished, quite septic and slightly under weight.

Examination of chest: Marked disturbance in contour of right chest, posterior lateral aspect due to previous operative procedure. There is a sinus discharging pus, seventh interspace, posterior axillary line, and a narrow cavity formation extending from the fifth to the tenth rib, same line. A partial collapse of the right lung is noted, and some osteomyelitis of the previously resected rib stumps.

## TREATMENT OF CHRONIC EMPYEMA

There is a regeneration with bridging and overlapping of the previously resected ribs. Capacity of cavity, 300 c.c.

Radiographic examination supports the above findings.

Bacteriological examination: Wassermann negative; sputum negative for tubercle bacilli; white blood-cells, 13,700; red blood-cells, 4,280,400; hæmoglobin, 75 per cent.; urine negative. Culture from cavity shows hæmolytic streptococcus, and staphylococcus aureus. Blood-pressure: systolic, 136; diastolic, 80; pulse-pressure, 56; vital capacity reading, 1800 c.c.

*Surgical Treatment, Fractional Procedure.*—April 10, 1922. Operation.—Resection of regenerated rib stumps from the fifth to the tenth rib inclusive; entire cavity laid open. Multiple fistulous tracts excised. Skin inverted over severed superficial muscles and fixed. Multiple scarifications of skin to cause relaxation along suture line. Implantation of a portion of the deep fascia into the apex of the exposed tract. Preparation of the entire cavity for active Dakinization.

May 17, 1922. Operation.—Resection of a mass of regenerated bone *in situ* of cavity and removal of an additional portion of the ninth rib, posterior aspect, with excision of sinus tract leading down under same. The entire cavity left open for continuous Dakinization.

June 7, 1922. Operation.—Plastic closure, muscle and skin, of entire space remaining, following maximum lung expansion, with the implantation of a portion of the latissimus dorsi muscle into said space. Muscle and skin brought into apposition by means of silkworm gut sutures; Carrel tube and rubber dam drainage for twenty-four hours. Multiple scarifications of skin to cause relaxation.

June 20, 1922. All sutures and drainage having been removed and entire structure healed, patient feeling well, lung well expanded and all cavity obliterated, will be placed on calisthenics and deep breathing exercises before he is discharged from hospital.



## CHRONIC CATARRHAL CHOLECYSTITIS WITH LIPOID DEPOSIT

By JOHN R. CORKERY, M.D.

OF SPOKANE, WASH.

CHRONIC catarrhal cholecystitis has had extensive investigation from the pathological standpoint.\* This paper further purposes to consider papilloma of the gall-bladder. The material for the paper was gathered in part in the study made at the Mayo Clinic on early lesions of the gall-bladder and on fish-scale gall-bladder, in part from cases in my own practice and part from pathological specimens from the practices of others. The methods of preparing material for study have been heretofore described.<sup>4</sup>

Papillomata of the gall-bladder occur as single or multiple lesions of the mucosa. They appear in white, yellowish bunches, grapelike bodies, insecurely attached to the mucosa by a very slender filament of tissue and are from .5 mm. to 5 mm. in diameter. These are easily brushed off. They are found upon microscopic study to be composed of a papilloma-like mass. The cellular changes present are identical with those which are found in forms of chronic catarrhal cholecystitis with lipoid deposit, namely, fish-scale and strawberry gall-bladder. Briefly reviewed, they are the following:

(1) Distortion of the villi due to infiltration of leucocytes, fibrosis, and lipoid deposit and other products of inflammation.

(2) The mucosa is always intact except for artefact.

(3) The lipoid substance is seen in the type of the epithelial cells lining the lumen and the acini, around the nuclei, and in the base, just under the base of the epithelial cells, in large polygonal cells or round cells in the submucosa, sparingly in connective-tissue cells and muscle cells, in leucocytes in the stroma, in the walls of blood-vessels and in the lumen. The lipoid is usually deposited in fine granules, but may become so packed that the granules disappear and the mass is homogeneous. The polygonal shape of the large cells in the submucosa is due to their being tightly packed with lipoid in a space too small for the spherical shape to be retained.

(4) Round-cell infiltration is noted in amounts proportional to the amount of lipoid deposited.

(5) Polymorphonuclear leucocytes are often noted, but the picture is that of an acute infection engrafted on a chronic infection.

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\* Among other pieces of work are—

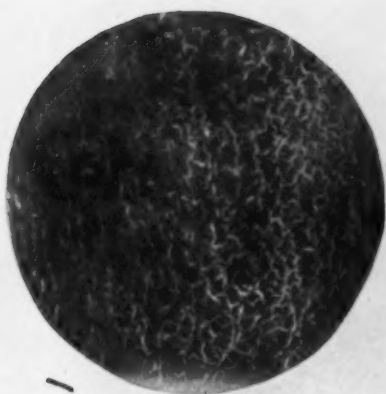
<sup>1</sup> MacCarty, W. C.: Strawberry Gall-bladder. *ANNALS OF SURGERY*, 1910.

<sup>2</sup> Irwin and MacCarty: Papilloma of Gall-bladder. *ANNALS OF SURGERY*, 1915.

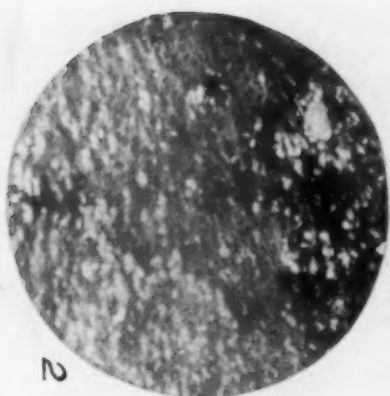
<sup>3</sup> MacCarty and Corkery: Early Lesions of Gall-bladder. *American Journal of Medical Sciences*, 1920.

<sup>4</sup> Corkery, J. R.: Fish-scale Gall-bladder. *ANNALS OF SURGERY*, 1920.

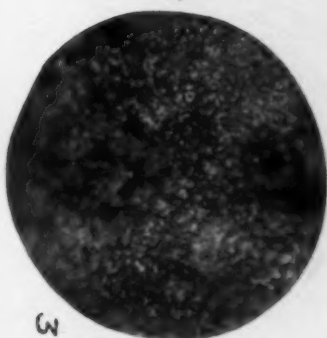
<sup>5</sup> MacCarty: The Pathology of Gall-bladder and some Associated Lesions. *ANNALS OF SURGERY*, 1910.



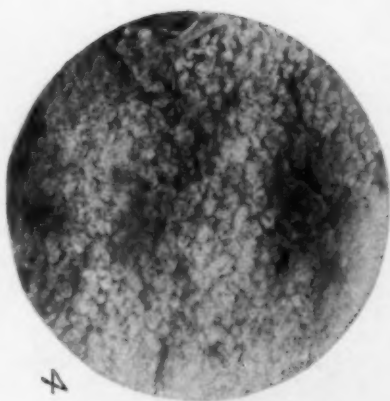
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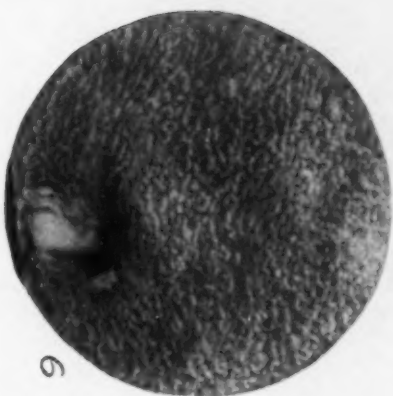
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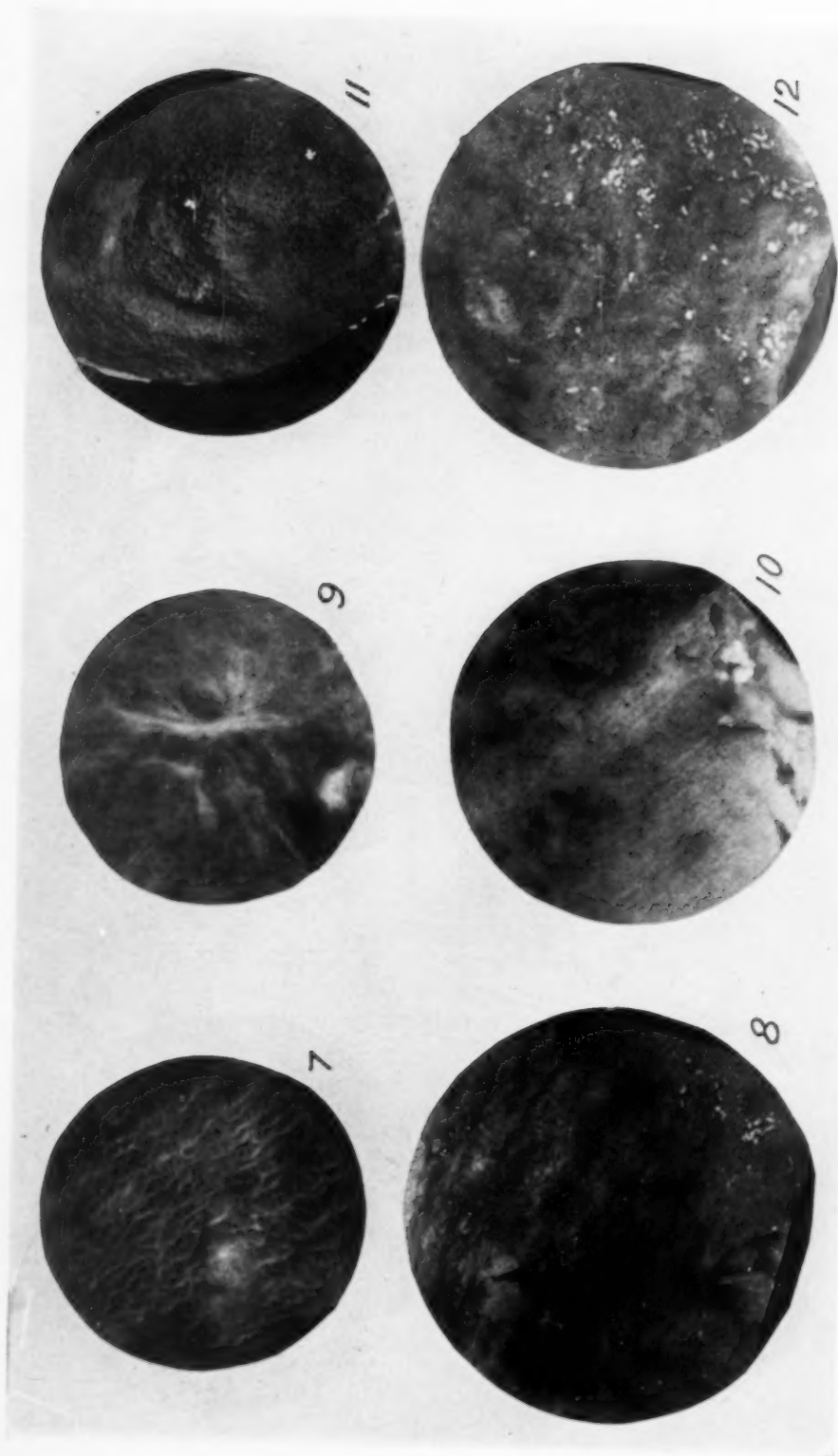


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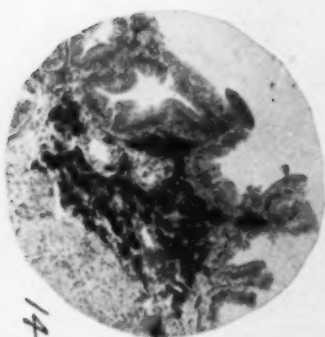
Figs. 1 to 6.



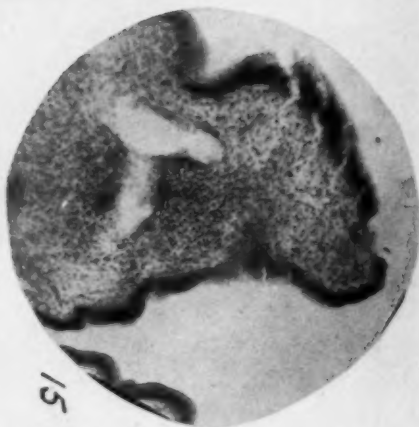
FIGS. 7 to 12.



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15



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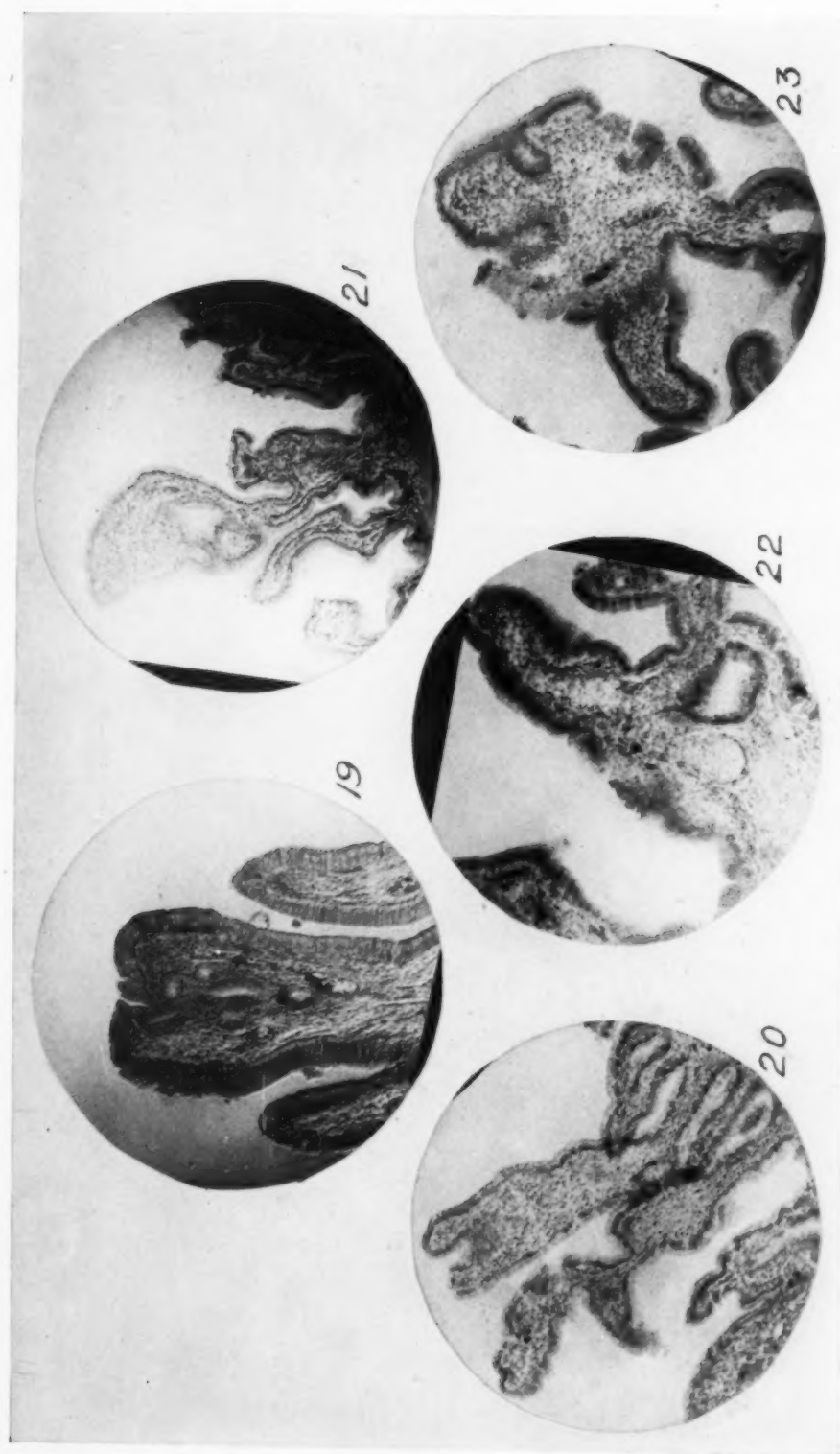


17



18

FIGS. 13 TO 18.



FIGS. 19 to 23.



## CHOLECYSTITIS WITH LIPOID DEPOSIT

(6) Fibrosis exists in every case, particularly in the tips of the villi. Round cells may be absent as well as polymorphonuclears and lipoid, but the constant feature is fibrosis. In many cases where lipoid could not be seen on visual inspection nor with the 52-mm. lens, it was noted microscopically in small amounts.

(7) As inflammation changes the villus, there is in addition to the usual accompaniments of inflammation a deposition of lipoid, but the greatest change is produced by fibrosis. The villus becomes broader at the base, shorter in long axis, and enlarged at the tip, so as to be almost spherical. This process goes on and in the formation of a papilloma it appears that the base of the villus, or villi, becomes narrowed to a slender filament. This tends to cut off the blood supply which would make conditions favorable for the necrosis of the papilloma and its exfoliation.

The only apparent difference between strawberry and fish-scale papilloma of the gall-bladder is the shape of the yellowish-white masses.

Clinically, the examination of the history of these cases shows no feature distinguishable from features found in forms of chronic catarrhal cholecystitis with lipoid deposit. These symptoms include pain more or less definite in the right costal region, at times fever and leucocytosis, occasionally jaundice, belching of gas, nausea, and vomiting, very moderate loss of weight or none at all. Pathologically, it may or may not be found with stones in the gall-bladder or stones of hepatic or common duct or other associated conditions therein.

The purpose of this study is to fix, if possible, the etiological factor in papilloma and to make a pathological classification which will coördinate with the clinical findings, the surgical findings and the pathological findings. MacCarty and Irwin<sup>2</sup> state that "papillomata of the gall-bladder have been seen so frequently in the experience of the writers and have received so little attention in the literature, that it seems advisable at this time to describe and record the condition somewhat in detail, especially since they *belong to the neoplasms*, a group which, as our knowledge increases, is becoming more intimately associated with chronic inflammatory reactions."

We have already stated that the clinical history, the surgical findings, and the post-operative results in papilloma are indistinguishable from those of strawberry gall-bladder and fish-scale gall-bladder. It is apparent to us that these three also differ in no way, except in gross characteristics in a pathological sense. The observations made, warrant the conclusion that papilloma of the gall-bladder, wherever found in the series studied, is not a neoplasm, but is a result and an occasional accompaniment of chronic cholecystitis. From our observations, in this and other studies, it also seems apparent that the scarring and irritating and resultant changes of the mucosa of the gall-bladder produce in order, strawberry appearance, fish-scale appearance, and papilloma appearance of the gall-bladder. Since these are not pathological entities and are part of the same process, it seems more simple to discard these confusing terms and utilize chronic catarrhal cholecystitis

with lipoid deposit to designate all three of them, and to restrict papilloma to designate those rare cases where a true neoplasm is present.

An hypothesis is needed to correlate certain clinical, surgical, pathological and post-operative result findings. These findings are:

(1) Certain cases whose clinical history points strongly to disease of the gall-bladder, are productive, on cholecystectomy, of nearly normal specimens in the laboratory of surgical pathology and yet the patients are markedly benefited by the operation.

(2) Clinically, cases of gall-bladder disease show in their course, exacerbations and recessions.

(3) Good clinical results are obtained in the above character of cases by Meltzer Lyon treatment.

(4) Gall-bladders are found having all other characteristics of strawberry, fish-scale and papillomatous appearance, except lipoid deposit.

(5) All three of the above appearances, separate or combined, may be noted in limited areas of an otherwise nearly normal gall-bladder mucosa.

Therefore, an hypothesis may be constructed to correlate these facts and to visualize the life history of a gall-bladder the seat of a chronic inflammation as follows: A gall-bladder the seat of chronic inflammation may have one or all three of the above appearances at different times in the course of the disease; as aggression and regression take place the picture changes, and at operation may present any view from a gall-bladder restored to nearly normal, to one the seat of chronic obliterative cholecystitis.

#### EXPLANATION OF FIGURES

Fig. 1.—Nearly normal gall-bladder with mucosa. x 2

Fig. 2.—Strawberry gall-bladder with single mass having papilloma appearance. x 2

Fig. 3.—Fish-scale appearance. x 2

Fig. 4.—Fish-scale appearance without lipoid deposit. x 2

Fig. 5.—Nearly normal gall-bladder mucosa with two masses having papilloma appearance. x 2.

Fig. 6.—Definite chronic catarrhal cholecystitis with single papilloma appearance. x 2

Fig. 7.—Definite chronic catarrhal cholecystitis with two papilloma-like masses. x 2

Fig. 8.—Fish-scale appearance without lipoid with area of strawberry and single papilloma appearance. x 2

Fig. 9.—Chronic catarrhal cholecystitis with stellate scar of former cholecystostomy and single papilloma appearance. x 2.

Fig. 10.—Approaching cholecystitis obliterans with two papilloma-like masses.

Fig. 11.—From MacCarty and Irwin. "Papillomata of Gall-bladder." x 1

Fig. 12.—Chronic catarrhal cholecystitis with appearance impossible to classify, as strawberry, fish-scale or papilloma, grossly or microscopically. x 2

Fig. 13.—Section nearly normal gall-bladder mucosa. x 10

Fig. 14.—Strawberry gall-bladder. x 10

Fig. 15.—Fish-scale gall-bladder. x 10

Fig. 16.—From MacCarty and Irwin. "Papilloma of Gall-bladder." x 10

Figs. 13, 17, 19, 20, 21, 22, 23, represent in serial form the alteration by inflammation occurring in a villus to transform it from a nearly normal condition to a papilloma-like condition.

## ASEPTIC RESECTION OF INTESTINE

END-TO-END ANASTOMOSIS AND IMMEDIATE RESTORATION OF LUMEN  
BY USE OF SPECIAL APPLICATION OF REMOVABLE  
LOOPED LIGATURE

By FOSTER K. COLLINS, M.D.

OF LOS ANGELES

DEMONSTRATOR OF SURGERY IN LOS ANGELES POST-GRADUATE DEPARTMENT, UNIVERSITY OF CALIFORNIA

IN the ANNALS OF SURGERY, March, 1922, there appeared an article by William Stewart Halsted, M.D., Baltimore, entitled "Blind-end Circular Suture of Intestine, Closed End Abutted and the Double Diaphragm Punctured with a Knife Introduced Per Rectum." The technic suggested is most ingenious and the preliminary report seemed to prove the practicability of the method. This method can, however, be used only upon a limited portion of the lower intestine, since the knife introduced through the rectum to cut the tied-off diaphragm can be introduced but a limited distance. Since the above article appeared I have experimented upon dogs in the Surgical Laboratory of the Los Angeles Post-graduate Medical Department of the University of California, endeavoring to perfect a modification of the Halsted operation enabling it to be performed upon any portion of the intestinal tract. Fifty operations have been performed upon dogs and a definite technic demonstrated to my classes in surgery. On May 1, 1922, the technic was demonstrated before the staff of the Clara Barton Hospital, Los Angeles. The results seem to justify a preliminary report upon a technic for as nearly as possible aseptic resection of any portion of the intestinal tract. This preliminary report is offered as a modification of the Halsted operation with full credit to the article mentioned for suggestions given.

The success of this operation depends upon the proper application of a looped ligature, a single slip knot, of strong linen or silk, holding the ends of the intestine until such a moment as the end-to-end anastomosis is completed, when by a gentle pull this looped ligature is removed, fully opening the lumen of the intestine. Medium-sized Kocher clamps placed with tips at the mesenteric border secure the ligature, tied quite taut with the single loop, until it is ready to be removed, and do much to facilitate easy suture. The entire operation can be carried out quickly with an exact technic and if required without an assistant.

Those who have seen the demonstrations seem enthusiastic over its simplicity and the exactness with which the technic can be performed. In this, as in the Halsted operation, there are left protruding into the lumen of the bowel after the anastomosis is completed rather long margins, inturns, of the cut ends of the intestines. Doctor Halsted points out particularly that these give no trouble and have been taken care of by nature satis-

factorily in the dogs operated upon. In my modification the holding Kocher clamps placed over the retaining looped ligature enables the cautery to burn snug against the clamp without endangering the ligature, thus leaving

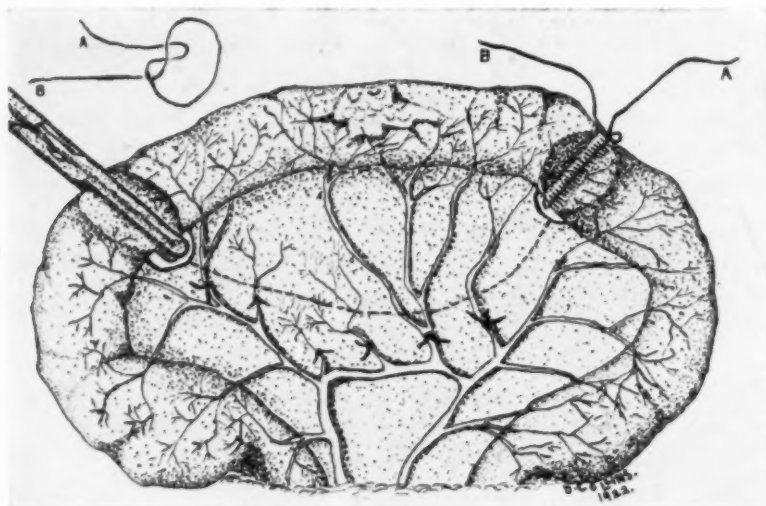


FIG. 1.—At points determined for resection of intestine, the mesenteric border is freed from its attachment for a short distance. A Kocher clamp crushes the intestine at this point and is removed. A looped ligature, as indicated by the insert, is to be tied along the crushed area.

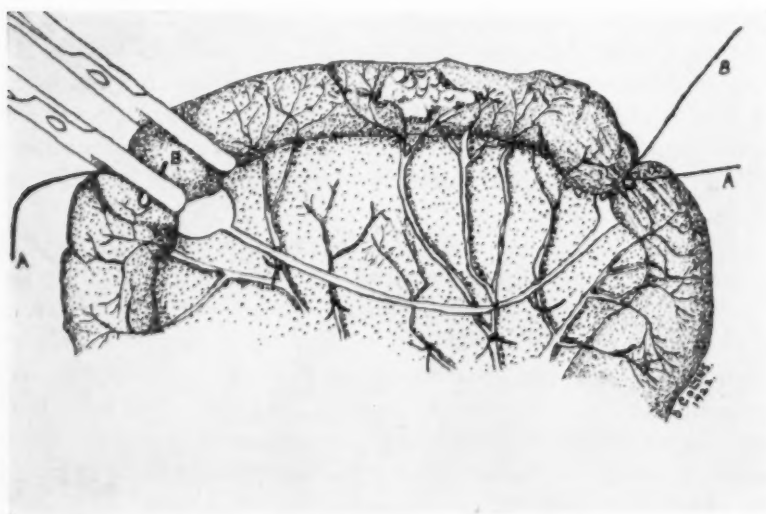


FIG. 2.—Looped ligature of strong linen or silk drawn taut, a Kocher clamp is in place over looped ligature, the loop with its end (A) is left long and protected by the clamp. The end (B) cut short.

a shorter charred margin to be quickly absorbed and less return to be cared for. By the use of this holding clamp no margins have to be trimmed away with scissors, making the act of resection entirely aseptic, and one feels the sense of absolute security against a possible leakage at the cut ends

## ASEPTIC RESECTION OF INTESTINE

while suturing. If the ligature alone is depended upon it could be cut by scissors or cautery with a resulting widespread contamination. With ligatures and clamps in place and the portion desired resected, the ends to be anas-

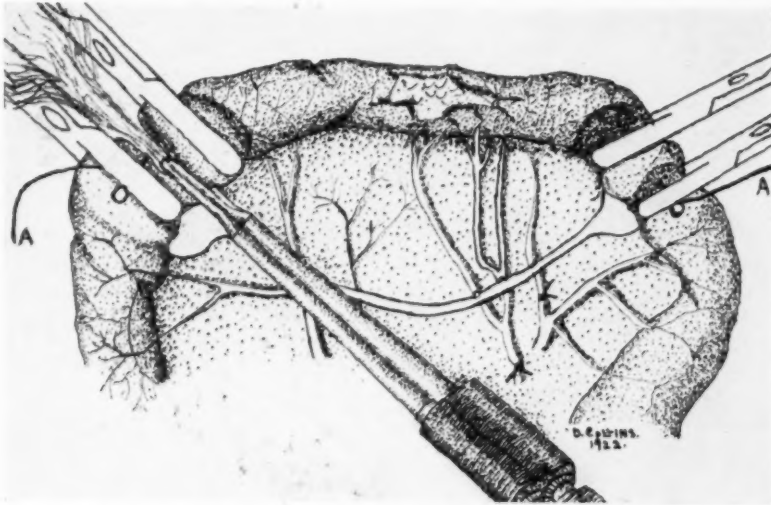


FIG. 3.—Resection between clamps by use of a cautery burning close to clamp.

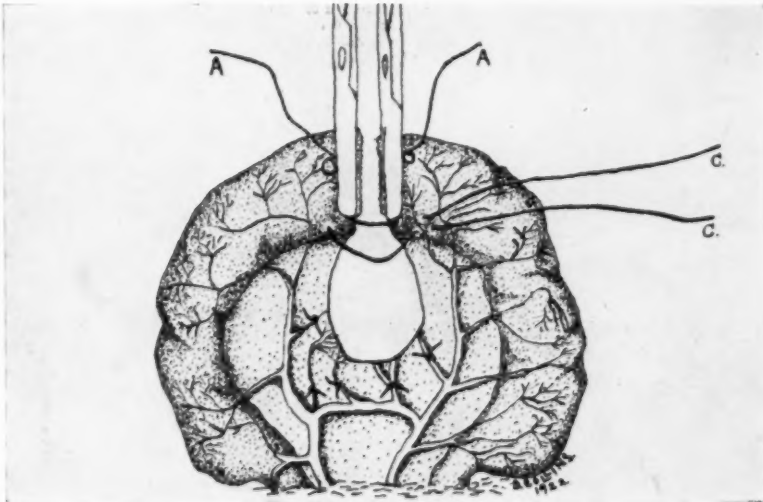


FIG. 4.—Resected portion removed. Ends to be anastomosed are easily abutted and held by the clamps ready for suture. The suture is best started at the mesenteric border and placed to close the mesenteric space as it splits to go about the intestine. This approximates the intestine ends and covers tip of clamps.

tomosed can be abutted easily in all cases, and by holding both clamps and the ends of looped ligatures in one hand the parts are readily kept constantly in the correct position for suturing. All handling of the remaining intestine is thus avoided. The suture should not penetrate the mucosa, can be a continuous or mattress one and is best started at the mesenteric border and



placed so that it closes the space where the mesentery layers split to go about the gut. This row of sutures is placed one-half inch or more from the clamps, enabling the surfaces of the intestine to approximate without tension,

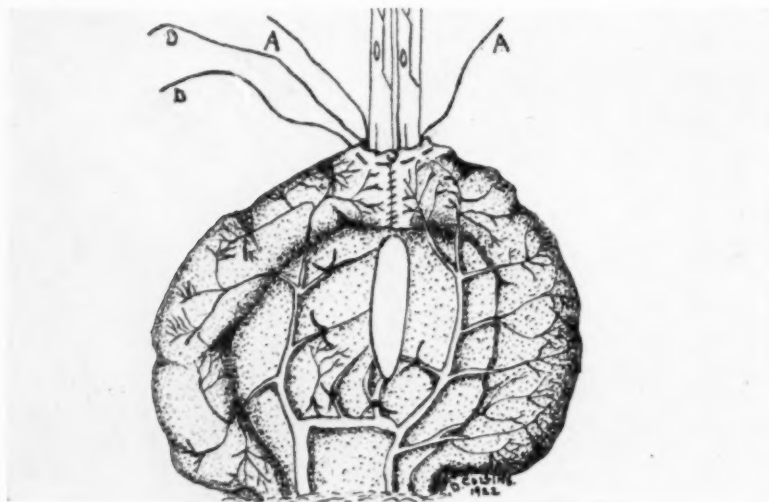


FIG. 5.—The suture is continued until the anastomosis is completed save at the point where the shanks of clamps protrude. A purse-string suture (D) is run about the protruding shanks of clamps. As clamps are removed this purse-string is tightened, closing the anastomosis about the looped ligatures (A) that still protrude.

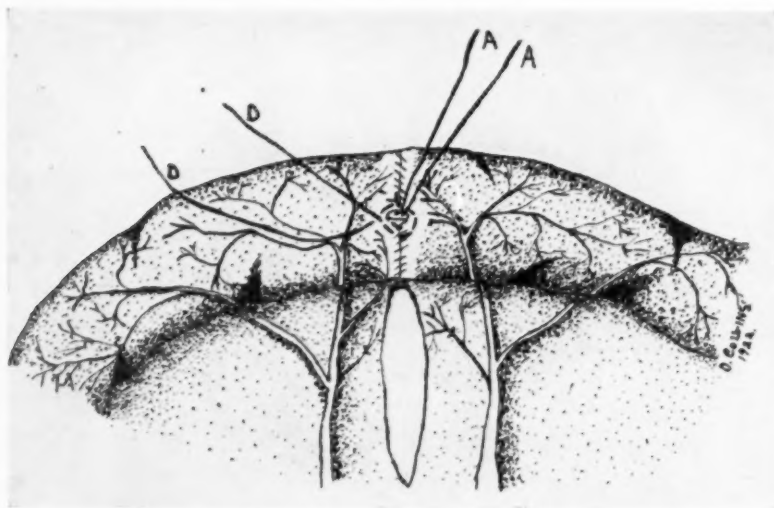


FIG. 6.—Clamps withdrawn. Retaining looped ligatures (A) are still fastened on the ends of intestine preventing any leakage from the bowel; they are withdrawn as the purse-string (D) is tightened, completing the anastomosis.

and is continued to edge of clamp above and tied. The other side of the anastomosis is also sutured up from the mesenteric border in a similar manner. If desired a secondary row of sutures can be placed at this time. A purse-string suture is now run about the portion of the anastomosis where

## ASEPTIC RESECTION OF INTESTINE

the clamps protrude. This is tightened as the clamps are removed until it is snug, but not tight around the protruding ends of the looped ligatures that still hold the cut ends of the intestines. A gentle pull now removes these ligatures and the purse-string is fully tightened, preventing any soiling whatever. Any reinforcing suture can be placed if thought wise. Usually with the clamps and ligatures removed, the edges of the infold do not part at once. The crushing and burning of ends has caused enough of agglutination of parts to still hold the lumen closed, a gentle manipulation opens the lumen and the bowel functions freely.

The larger the lumen of the gut the easier the steps. On the smallest gut of dogs the method can be executed by cutting the gut obliquely from its

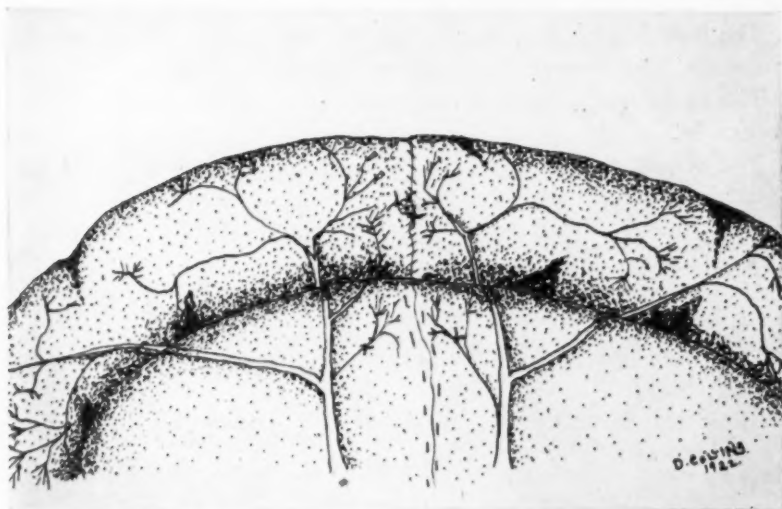


FIG. 7.—Looped ligature (A) withdrawn and anastomosis completed with lumen open for immediate function.

mesenteric border, thus increasing its lumen while preserving its blood supply. A gut of smaller lumen can likewise be cut obliquely, enabling end-to-end anastomosis to a gut of larger lumen. We are using the method upon live subjects and hope to report more fully at an early date. The following cuts illustrate the steps of the operation:

Figure 1. At points determined for resection of intestine, the mesenteric border is freed from its attachment for a short distance. A Kocher clamp crushes the intestine at this point and is removed. A looped ligature, as indicated by the insert, is to be tied along the crushed area.

Figure 2. Looped ligature of strong linen or silk drawn taut, a Kocher clamp is in place over looped ligature, the loop with its end (A) is left long and protected by the clamp. The end (B) cut short.

Figure 3. Resection between clamps by use of a cautery burning close to clamp.

Figure 4. Resected portion removed. Ends to be anastomosed are easily abutted and held by the clamps ready for suture. The suture is best started at the

## FOSTER K. COLLINS

mesenteric border and placed to close the mesenteric space as it splits to go about the intestine. This approximates the intestine ends and covers tip of clamps.

Figure 5. The suture is continued until the anastomosis is completed save at the point where the shanks of clamps protrude. A purse-string suture (D) is run about the protruding shanks of clamps. As clamps are removed this purse-string is tightened, closing the anastomosis about the looped ligatures (A) that still protrude.

Figure 6. Clamps withdrawn. Retaining looped ligatures (A) are still fastened on the ends of intestine, preventing any leakage from the bowel; they are withdrawn as the purse-string (D) is tightened, completing the anastomosis.

Figure 7. Looped ligature (A) withdrawn and anastomosis completed with lumen open for immediate function.

### ADVANTAGES IN CONCLUSION

1. The method can be applied to any portion of the intestinal tract except lower rectum, and remove any number of inches or feet.
2. The resection is aseptic, the suturing as nearly so as any non-penetrating suture can be.
3. The suturing is greatly facilitated by the clamps which at the same time guard the looped ligature.
4. No handling of the remaining intestine, through its lumen or externally, is required.
5. Simply withdrawing the looped ligature opens the lumen and enables the bowel to function.
6. The whole operation can be performed with surprising quickness, thus minimizing shock.
7. All of the advantages of an end-to-end anastomosis are gotten without contamination.

## ASEPTIC TECHNIC FOR THE RESECTION OF INTESTINE\*

BLIND END-TO-END ANASTOMOSIS WITH THE RELEASE OF PURSE-STRING  
SUTURE AFTER THE ANASTOMOSIS IS COMPLETE

BY CYRUS F. HORINE, M.D.

OF BALTIMORE, MD.

FROM THE DEPARTMENT OF OPERATIVE SURGERY, UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE

IN a review of the literature of intestinal surgery I have found that about two hundred and twenty-five different methods of anastomosis have been devised, of which a score of them have been presented as attempts to do a resection without contamination. Theoretically, this is impossible. If a series of a large number of cases be taken and cultures made from the line of suture, there would be some cultures positive. The underlying principles for doing a gut resection have been very well established, but there is that one problem that still confronts the surgeon in the resection of intestine, namely, infection from the contents of the gut. When the usual methods of resection as the end-to-end and lateral anastomosis are done, the field of operation is exposed to fecal matter, peritonitis may prevent a primary union in the line of suture, resulting in a breaking down of the anastomosis and a development of a fecal fistula. This is especially true in the resection of large intestine where organisms are more virulent and in greater numbers. It is a well-known fact that in the resection of small intestine, where strict technic is observed, peritonitis is less likely to occur where the point of resection is remote to the ileocaecal valve.

Figure One. To defeat contamination in the removal of intestine the entire operation must be carried on from without, the moment any instrument is introduced into the lumen of the gut the technic is broken so far as infection is concerned. The proximal and distal portions of gut to the segment to be removed must be isolated from the field of operation. This is done by using a purse-string suture of heavy silk or linen thread. The suture is started at a point distal to the mesentery so that when tied the knot will be above, facing the operator. The suture takes in all the coats of the intestine except the mucous coat. A clamp is now placed on each end of the intestine to be resected, between the two purse-string sutures. The mesentery is taken care of as in any method of resection. The intestine is then divided between the clamp and purse-string suture by electric cautery and the segment of gut removed.

Figure Two. This diagram shows the way in which the purse-string suture is tied before the gut has been severed with the cautery. AA is a free hand string of linen thread placed between the gut and the first knot

\* Read before the Baltimore County Medical Society, April, 1922.

of the purse-string suture. As a way to distinguish this string a knot has been tied in each end.

Figure Three. The knot in the purse-string has been completed, showing AA and BB. BB is the second free-hand string between the first and second knot of the purse-string suture. The rosette of severed gut has been omitted in order to demonstrate clearly the knot. PP are the cut ends of the purse-string suture.

Figure Four. The purse-string suture tied, showing knots with release strings. At this step the segment of gut is ready to be removed.

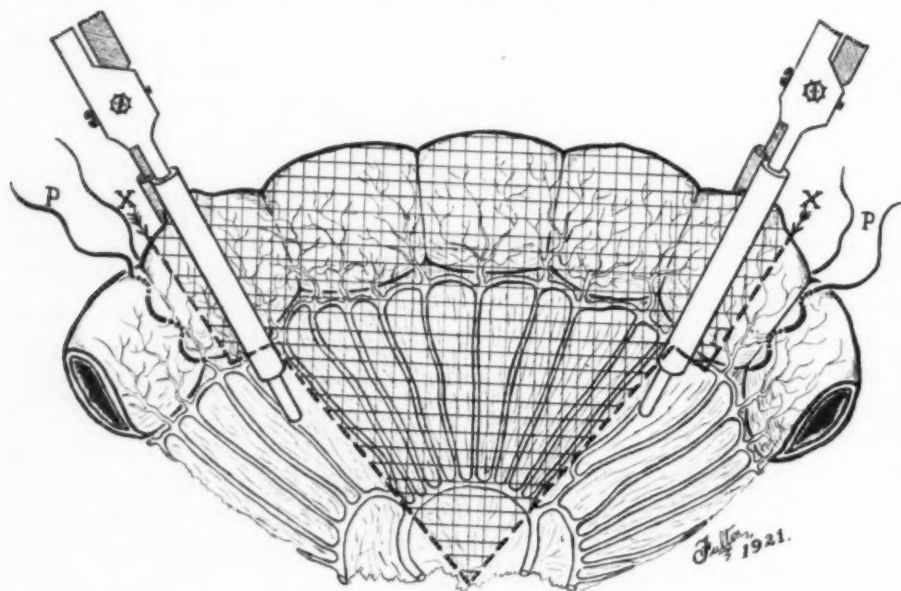


FIG. 1.

Figure Five. The proximal and distal stumps are now brought into apposition and joined together by interrupted mattress sutures of intestinal silk. It is better that this procedure be started at the mesenteric border and continued around the gut on one side to the point distal to the mesenteric attachment, and in the same way on the other side. The diagram is a longitudinal section of gut showing PP' the purse-string suture tied, the release strings being carried out between the mattress sutures. M is the mattress suture which takes in all the coats of intestine except the mucosa. As the release strings are brought out between the mattress, the close approximation of the two ends of the gut is not interfered with to any extent, as very little space is required in doing so, the two surfaces being closed as neatly as though the release strings were not present.

Figure Six. The anastomosis has been completed and a quarter section of gut removed. M demonstrates the tied mattress sutures. The release strings AA' and BB' between the mattress sutures are ready to be released.



ASEPTIC RESECTION OF INTESTINE



FIG. 2.

Figure Seven. A longitudinal section of the anastomosis showing the release of the knots of the purse-string sutures, allowing the lumen of the

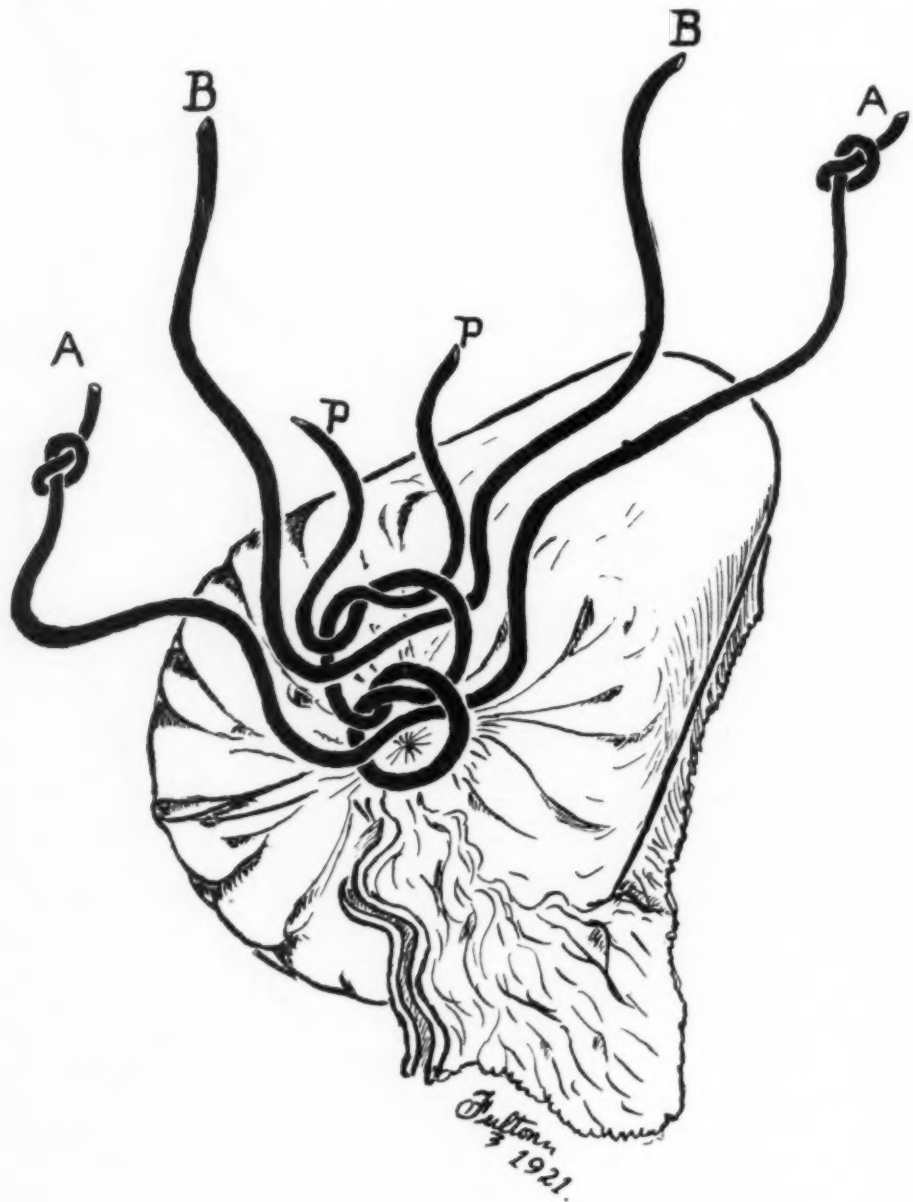


FIG. 3.

gut to be opened after the anastomosis is completed. The arrow indicating the lumen of the gut and the direction of flow of the fecal contents. P the released purse-string suture. Referring again to Figure Four, B and B' are

## ASEPTIC RESECTION OF INTESTINE

the first release strings to be withdrawn. This manœuvre opens the first knot of the purse-string suture. A and A' are then withdrawn allowing the

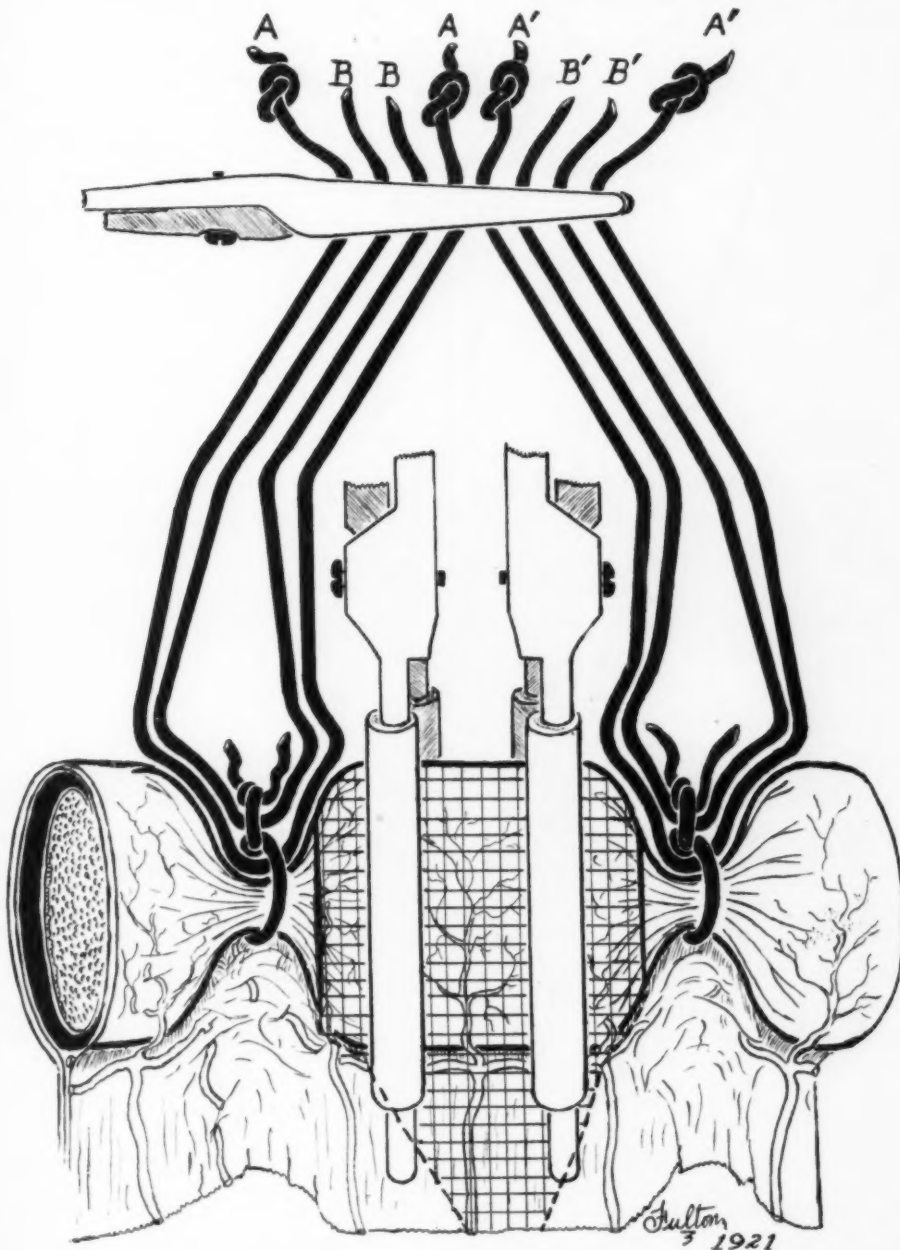


FIG. 4.

purse-string to be opened entirely. By doing this both ends of the gut are opened simultaneously. This prevents one end of released gut contaminating

the knot of the corresponding side. The purse-string suture is allowed to remain in the lumen of the intestine and subsequently passes out with the contents of the gut. L is a continuous suture of intestinal silk, taking in all

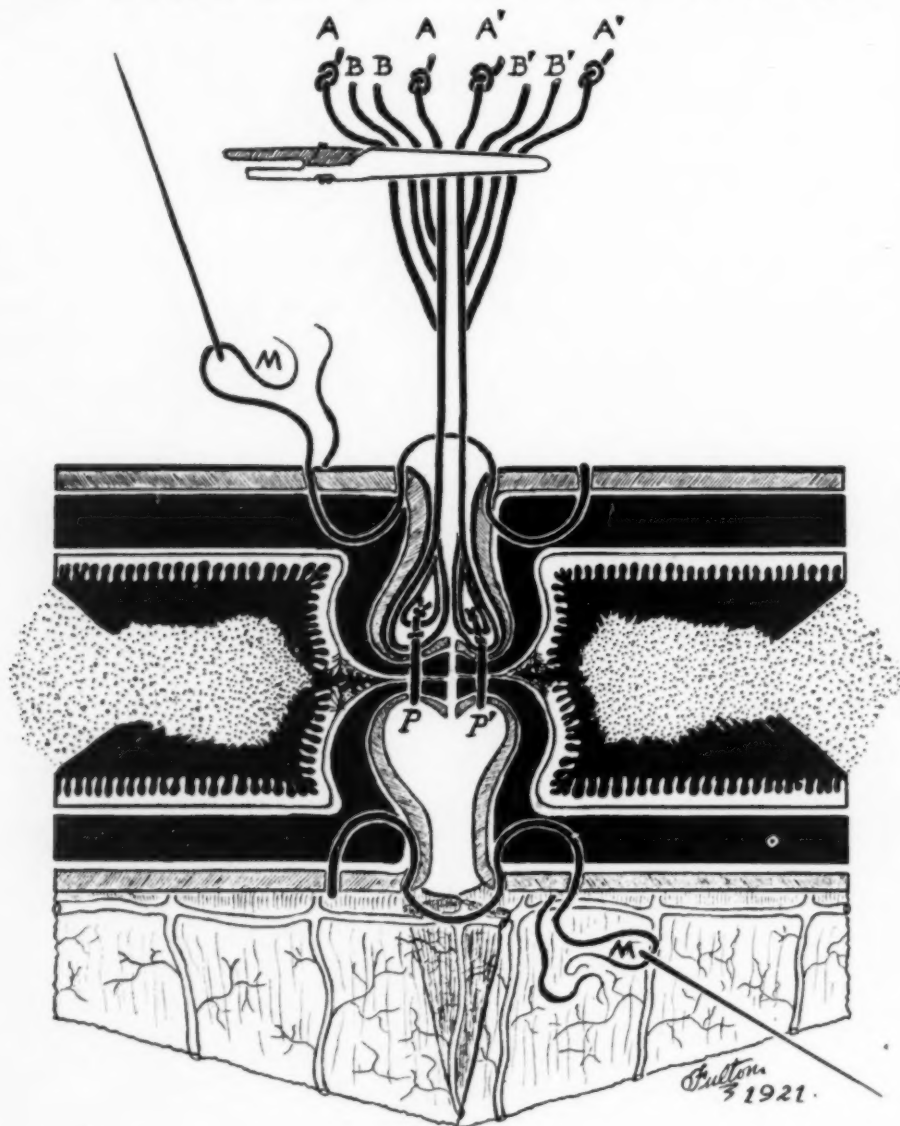


FIG. 5.

the coats of the gut save the mucous coat, which may be used to reinforce the mattress suture. This suture is entirely optional with the operator. The tension produced on the purse-string sutures when tied allows the lumen to open as the knots are broken, but to assure oneself that the lumen has been entirely opened, it is possible to push one end of the gut through the anas-

# ASEPTIC RESECTION OF INTESTINE

tomosis, or, by rotary motion of the anastomosis between the index finger and the thumb.

Figure Eight. Showing the operation completed.

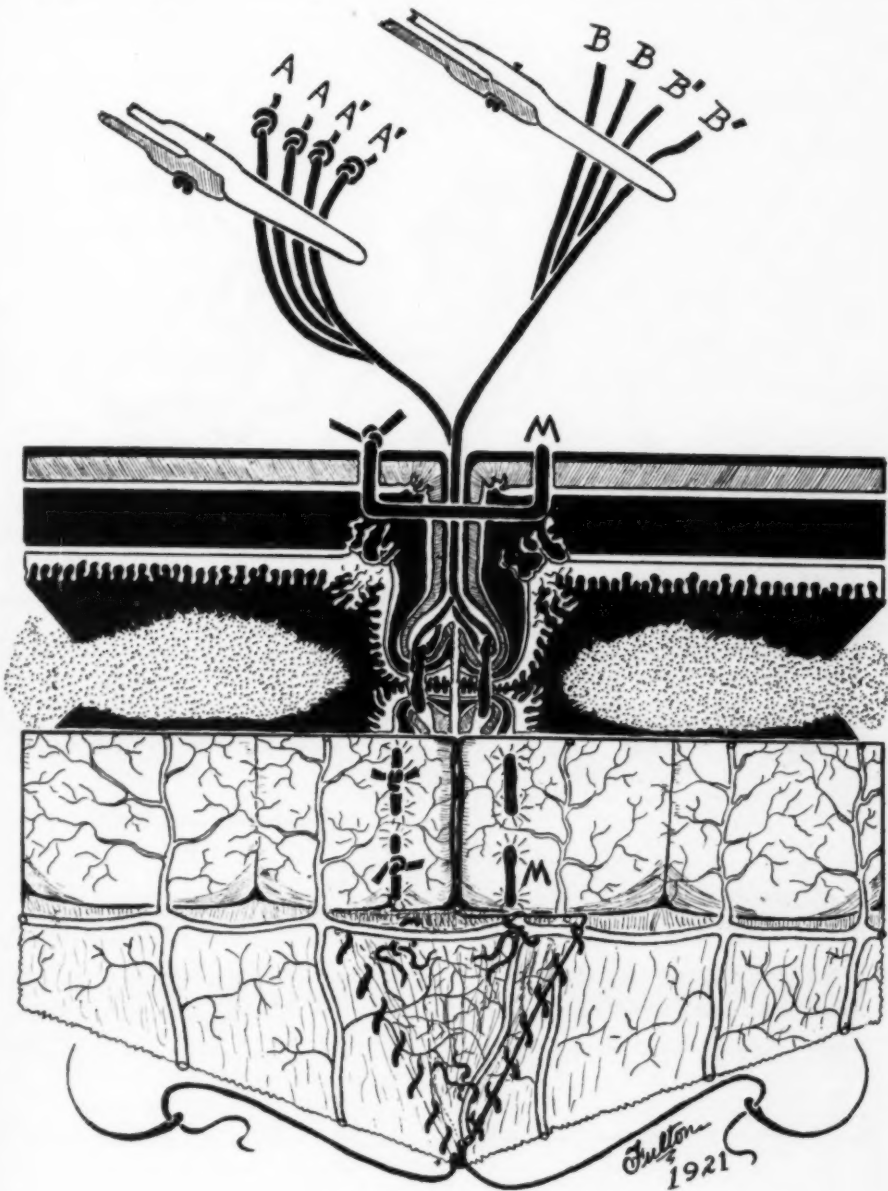


FIG. 6.

This operation has been done on ten dogs without a death and on two occasions has been done on patients. The first patient was operated for an annular carcinoma of the sigmoid, the second having a resection of small intestine about six inches from the ileocaecal valve.



On November 21, 1921, a resection was done on a dog, and it is now nine months up to the time of this writing, and the dog is apparently normal in every respect. Autopsies done on the other dogs at different intervals

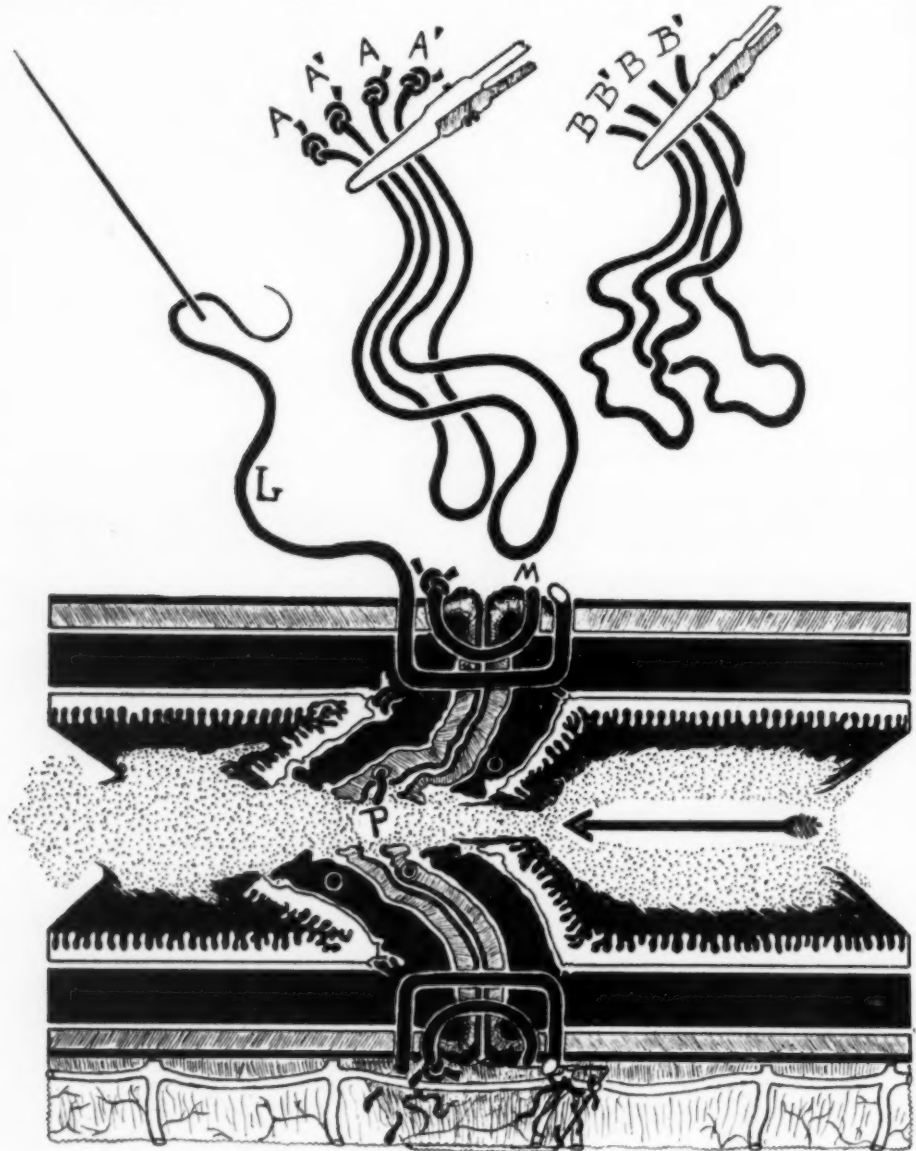


FIG. 7.

after operation showed no signs of leakage or stasis due to constriction at the point of anastomosis, the inturn of gut being absorbed between the third and fourth week after operation. The resections were done on all occasions on the large intestine.

## ASEPTIC RESECTION OF INTESTINE

In March, 1922, at the Bay View Hospital, I resected an annular carcinoma of the sigmoid on a patient who had had a colostomy previously done. This was not a fair test of the operation as the carcinoma had begun to ulcerate through the gut, and when clamps were applied to remove the section of gut some fecal matter was forced through the ulcerating area and broke the technic of the operation. The patient did well for six days after the operation, but died suddenly on the evening of the sixth day. An autopsy was refused and a definite diagnosis as to the cause of death was not made. Up

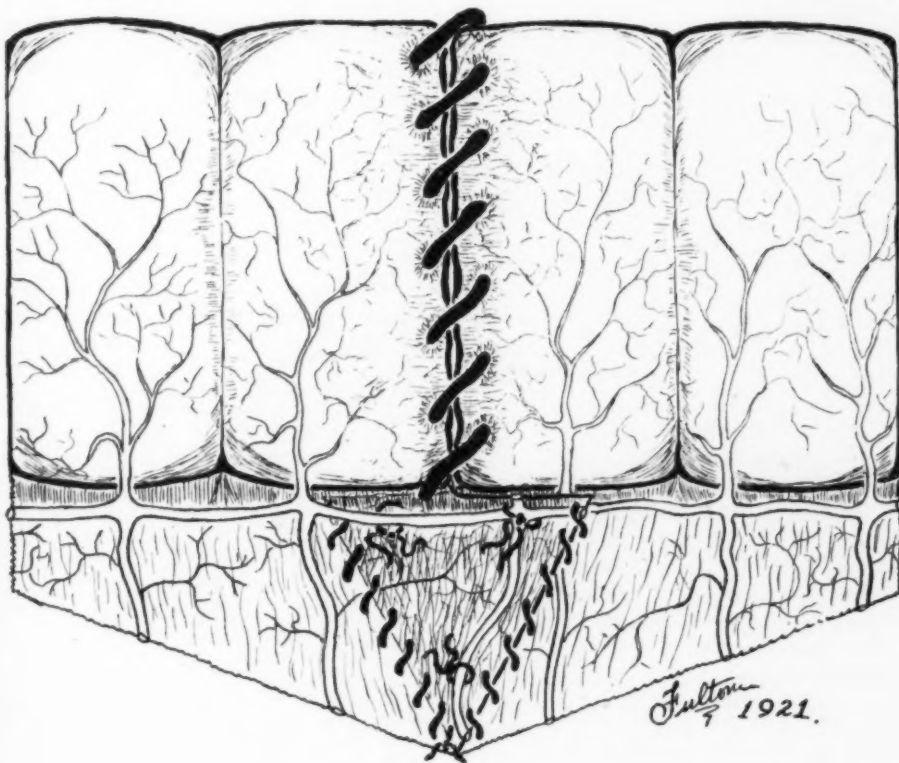


FIG. 8.

until the day of death the patient ran a normal course, pulse and temperature being normal, abdominal rigidity and distention absent. No vomiting or eructation at any time after the operation.

The second patient that I operated using this method was a case of obstruction due to a band. Patient, a colored girl, twenty-two years of age, was operated at the Maryland General Hospital in January, 1919, for bilateral salpingitis. She had an uneventful recovery and was discharged two weeks after operation as cured, wound healing primary. On March 27, 1922, she was admitted to the service of Professor Holland at the University Hospital, with a diagnosis of acute obstruction and was operated upon, using this method. It was necessary to remove about

four inches of intestine. She had a good recovery save for a small pulmonary infarct on the seventh day after operation, from which she recovered without any trouble. Fifth day after operation had a normal voluntary bowel movement. Given soft diet eight days after operation and was discharged from the hospital on the twenty-eighth day as cured. A gastro-intestinal series showed no stasis in the intestinal tract. Four months after operation this patient was again admitted to the service of Professor Holland with another obstruction, which was thought to be due to a stricture in the site of the previous operation. She was operated by Professor Holland, who found several coils of intestine adherent to the abdominal wall, but real obstruction was due to a band involving two loops of intestine. The point of previous anastomosis was several feet beyond the obstruction. There were no adhesions within several feet beyond the obstruction. The lumen of the intestine at the point of anastomosis would easily admit the finger. The peritoneum was studded with many small nodules, thought to be tuberculous, which were not present at the time of operation four months previous.

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## INVOLVEMENT OF THE LYMPH-NODES IN CARCINOMA OF THE RECTUM\*

BY JAMES ROBERT McVAY, M.D.

OF ROCHESTER, MINN.

FELLOW IN SURGERY, THE MAYO FOUNDATION

THE rectum next to the stomach is the most common location for malignant disease in the gastro-intestinal tract. Mayo reported 561 cases of malignant disease of the gastro-intestinal tract seen in the Mayo Clinic in

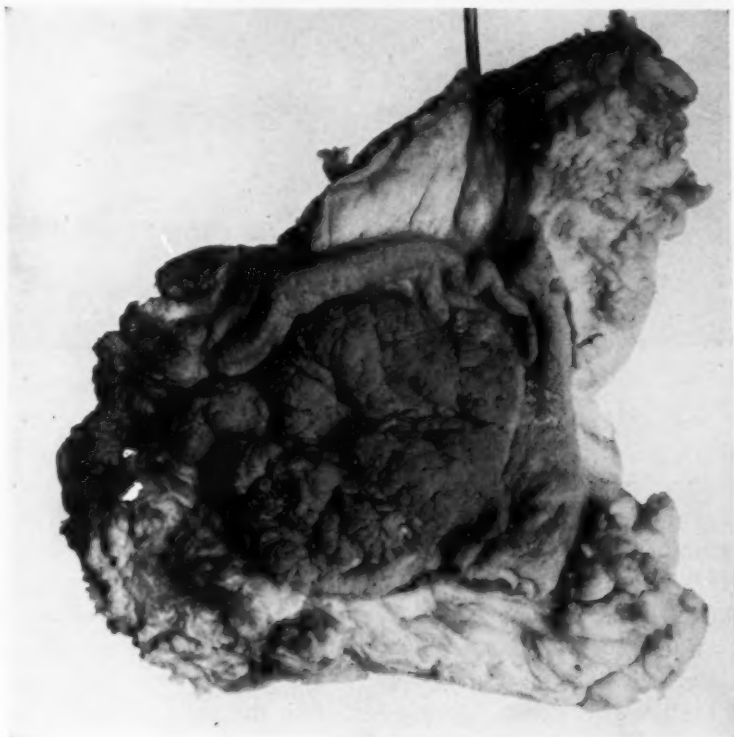


FIG. 1.—(Case A100372). Typical specimen of Group I.

1908 and 1909. Of these growths, 387 were in the stomach, three were in the small intestine, sixty-nine were in the large intestine, and ninety-two were in the rectum. Gant, Ball, and Halsted assert that rectal cancers make up about 4 per cent. of all the cancers of the body, and that about 80 per cent. of the intestinal cancers occur in the rectum.

Patients with cancer of the rectum are usually in the sixth decade, but

\* Abstract of thesis submitted to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Surgery, May, 1920.

they may be any age. W. J. Mayo, in 120 operative cases, found the average age to be fifty-two years. Oehler, discussing the cases in Kraske's Clinic, says the average age is fifty-six years, slightly higher in males than in females. He quotes Kupferle in Czerney's Clinic who reported a case of rectal carcinoma in a patient aged thirteen years and the Rostocker Clinic as having two cases in patients fourteen and fifteen years, respectively.

The disease is more common in males than in females. In 25,000 cases of disease of the rectum treated for fistula, reported from St. Mark's Hospital by Edwards, 775 were malignant. Five hundred forty-two of the



FIG. 2.—Longitudinal section of the growth shown in Figure 1.

patients were males and 233 were females. In Lynch's 491 cases there were 281 males and 210 females.

The duration of symptoms is usually under one year. Lynch found it to average eight months in 491 cases; in 20 per cent., it was from nine to twelve months.

Various writers fail to agree on the location of the growths. Cole gives the favorite site as the anterior and lateral walls; Rawling believes that the posterior wall is most often affected, and Oehler says that they occur as often on the anterior as on the posterior wall. Edwards asserts that about 80 per cent. of the growths occur 5 to 7.5 cm. from the anus; Gant, in 100 cases, found 50 per cent. in the ampulla and 15 per cent. in the upper rectum and sigmoid, while W. J. Mayo, in 100 consecutive cases, found 63 per cent. in the rectosigmoid, 30 per cent. in the rectum, and 7 per cent. in the anal canal. Mummery believes the commonest site is the rectosigmoid, and next the ampulla. He believes that those who say the growths occur at a lower level do not take into account the fact that they may descend after starting.

The usual type of growth is adenocarcinoma. In Lynch's 491 cases, 451 were adenocarcinomas. Of Gant's 100 cases, 95 per cent. were cylindric carcinomas, and in three-fourths of the cases studied by Oehler the growths were of the type which he calls adenocarcinoma simplex. In view of the various classifications which have been given to carcinomas of the rectum,



## THE LYMPH-NODES IN CARCINOMA OF RECTUM

some based on clinical grounds, others on histologic grounds, and still others developed from a combination of both, it seems best not to attempt any classification other than carcinoma.

Carcinoma of the rectum develops from the crypts or glands of Lieberkuhn which, when they take on their migratory activities, break through the tunica propria of the mucosa into the submucosa, invade the circular muscular coat and, on reaching the intermuscular lymphatic network, tend, according

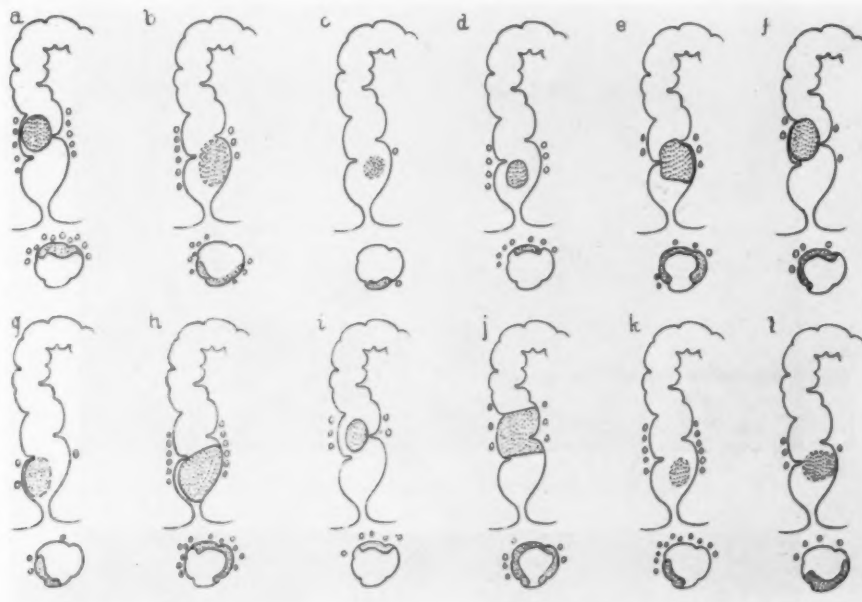


FIG. 3.—Diagram of relative position of glands and growth in twelve cases of Group 1. Glands not involved are shown as clear circles; glands involved are shown in solid black. *a* (Case A47322). Growth measuring 50 by 50 mm.; 10 cm. from anus. *b* (Case A57201). Growth on anterior wall measuring 50 by 70 mm.; 5 cm. from anus. *c* (Case A68756). Growth on anterior wall measuring 15 by 20 mm.; 5 cm. from anus. *d* (Case A70580). Growth on posterior wall measuring 25 by 33 mm.; 3 cm. from anus. *e* (Case A70730). Growth on posterior wall measuring 45 by 45 mm.; 6 cm. from anus. *f* (Case A81871). Growth on left and posterior wall measuring 40 by 50 mm.; 10 cm. from anus. *g* (Case A97023). Growth on anterior and left wall measuring 30 by 35 mm.; 3 cm. from anus. *h* (Case A100372). Growth on posterior and right wall measuring 50 by 70 mm.; 2 cm. from anus. *i* (Case A102528). Growth on posterior wall measuring 30 by 35 mm.; 10 cm. from anus. *j* (Case A103155). Encircling growth measuring 70 by 70 mm.; 10 cm. from anus. *k* (Case A104886). Growth on left and anterior wall measuring 20 by 25 mm.; 4 cm. from anus. *l* (Case 107782). Growth on anterior wall measuring 60 by 35 mm.; 4 cm. from anus.

to Cole, to progress around the bowel in the direction of these vessels. This accounts for the encircling tendency of rectal carcinoma. From here the cells invade the longitudinal muscle layer and on reaching the outer muscle wall their extension is restricted by the rectal fascia. The invasion of the lymph-nodes through the lymphatics may occur at any time after the disease reaches the submucosa, but such invasion is usually late. W. J. Mayo says that more cases are inoperable because of local extension than because of metastasis. Three methods of extension are described by Miles: Downward into the wall of the bowel below the growth, into the rectal sphincter, and ischiorectal fossa; lateralward into the fascia propria, levator ani muscles, capsule of the prostate, seminal vesicles, and base of the bladder in the male, and the vaginal

wall and genital organs in the female, and upward into the bowel above the growth, and the pelvic peritoneum and mesocolon. Handley has described a marked dissemination in the submucosa occurring early. This he claimed

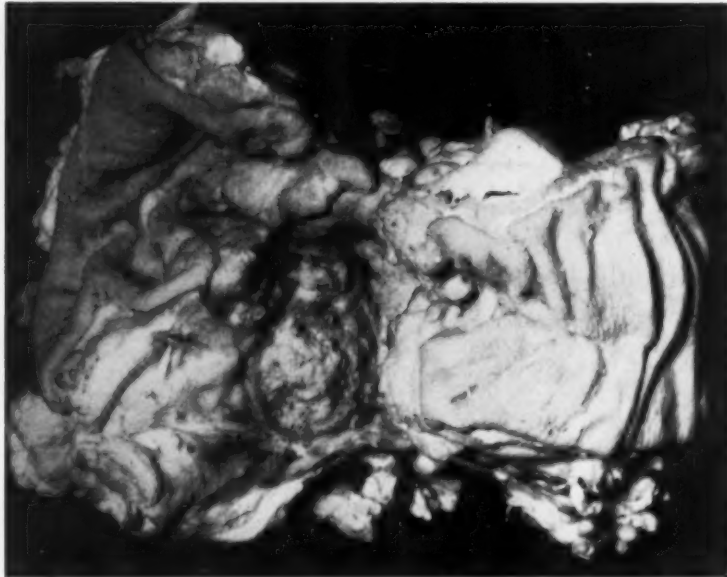


FIG. 4.—(Case A176669.) Typical specimen of Group 2.

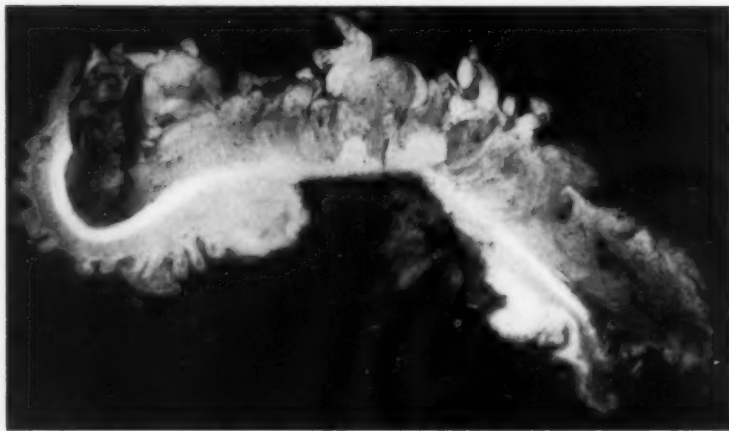


FIG. 5.—Longitudinal section of the growth shown in Figure 4.

to have demonstrated by mucicarmin staining of entire sections of the bowel. Cole, Monsarrat and Williams, and Cheattle were unable to confirm his findings.

Cancer of the rectum metastasizes slowly in most cases. Oehler had fifty-eight patients die from carcinoma of the rectum and thirty-four had no internal metastasis. Zinner found metastatic enlargement of retroperitoneal

## THE LYMPH-NODES IN CARCINOMA OF RECTUM

lymph-nodes in only 3.5 per cent. of the 141 patients examined. Pennington collected data on 997 necropsies of patients dying from cancer of the rectum and in 324 the regional nodes were found to be involved. Metastasis, when it does occur, usually takes place in the liver. Oehler says that metastasis is most frequent in the liver and retroperitoneal lymph-nodes and that the lungs are seldom involved, and the remaining organs still more seldom. Rectal carcinoma may reach the liver through glandular metastasis or by the breaking off of emboli of carcinoma cells into the portal circulation, a method recognized and described by W. J. Mayo, McArthur, Smith, and others.

*Materials and Methods.*—One hundred specimens were studied which had been removed at operation at the Mayo Clinic. The size, location, form, extent, and character of the growth were studied as well as the normal mucosa, skin, surrounding fat, and fascia. Photographs were then made of the specimens, one showing the growth from the mucosal side, and one showing a cross-section cut through the centre of the growth in the longitudinal axis of the bowel. The character and extent of the invasion of the growth into the sub-mucosa, muscular coats, glands, fat, and fascia were studied and sketches of the specimens were made, showing the relative location and size of the growth recorded in millimetres.

The anorectal lymph-nodes were then carefully dissected out, and as each gland was removed its location in the longitudinal and radial directions was recorded on the sketch. The glands were then placed in small phials correspondingly numbered and preserved in formalin. A section of the original growth was also made and similarly preserved. Frozen sections averaging about 10 microns in thickness were made of each gland and these were stained in hæmatoxylin and eosin and mounted in balsam.

The sections of the glands were studied for metastasis. On the sketches the results of the microscopic examinations were recorded for each gland with appropriate notes of any striking features.

The results were then recorded on printed diagrams. The diagrams were

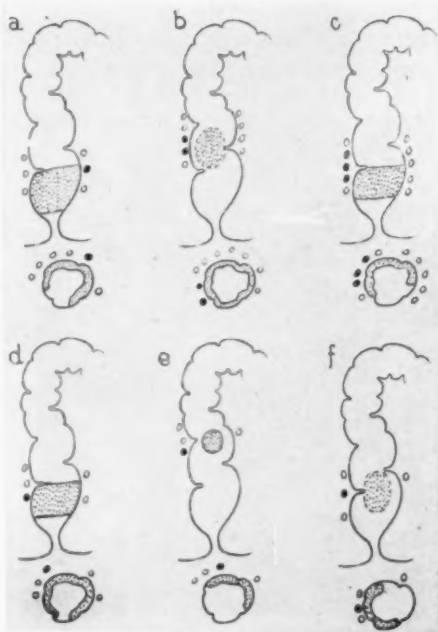


FIG. 6.—Diagram showing relative position of glands and growth in six cases of Group 2. Glands not involved are shown as clear circles; glands involved are shown in solid black. *a* (Case A174591). Growth on anterior wall measuring 95 by 60 mm.; 3 cm. from anus. *b* (Case A176669). Encircling growth measuring 50 by 60 mm.; 6 cm. from anus. *c* (Case A185201). Encircling growth measuring 45 by 40 mm.; 7 cm. from anus. *d* (Case A187873). Encircling growth measuring 80 by 55 mm.; 3 cm. from anus. *e* (Case A201505). Growth on posterior wall measuring 20 by 20 mm.; 12 cm. from anus. *f* (A250973). Growth on left wall measuring 50 by 50 mm.; 9 cm. from anus.

made to represent the sigmoid, rectum, and anus as viewed posteriorly and also the rectum in cross-section. The growth was sketched in its relative position and the lymph-nodes were placed as near as possible in the relative position in which they were found. Glands which showed no carcinomatous involvement on microscopic examination were represented as clear circles, while those showing metastatic involvement were represented in solid black. The variation in the size of the glands is not indicated in the diagram.

*Results.*—Forty-seven per cent. of the patients were in the sixth decade and 96 per cent. were between thirty-one and seventy years (Table I). The average age was fifty and eighty-eight hundredths years. The youngest were two patients twenty-nine years and the oldest was seventy-nine. There were fifty-seven males and forty-three females. The average duration of symptoms was ten and four-tenths months.

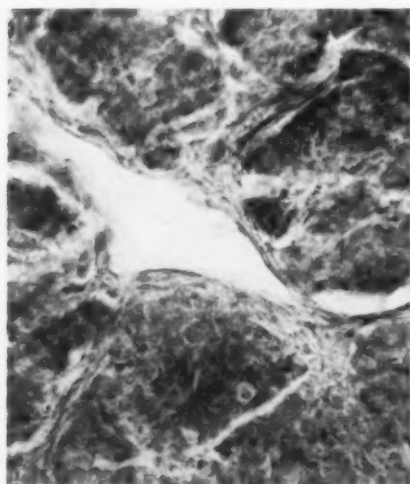


FIG. 7.—(Case A80564.) Metastasis in anorectal lymph-node. Cells show first degree of cytodifferentiation (X100).

Six hundred and twenty-three glands were obtained from the 100 specimens, or an average of six and twenty-three hundredths glands for each specimen. Fifty-three per cent. of the specimens did not show glandular involvement, 30 per cent. showed slight glandular involvement, and 17 per cent. showed marked glandular involvement. The cases may be readily classified into three groups: Group 1, cases of carcinoma of the rectum without metastatic involvement of the regional lymph-nodes. Group 2, cases of carcinoma of the rectum with metastatic involvement of less

than one-half of the regional lymph-nodes, and Group 3, cases of carcinoma of the rectum with involvement of one-half or more of the regional lymph-nodes.

*Group 1.*—This group contained fifty-three patients (53 per cent.). Thirty were males and twenty-three were females. The average age was fifty-one and six-tenths years. The average number of glands for each specimen was six and nine-hundredths (Table II).

One of the most striking features is that the size of the growth (Figs. 1 and 2) apparently bears no relation to the extent of glandular involvement (Fig. 3). Most of the growths in this series were above the average in size and caused symptoms of equal or longer duration than the average for the series. Most were protuberant and appeared to be growing into the lumen of the bowel rather than into the bowel wall, as is seen in the cross-section of the growth. Little attempt at direct extension into the muscle and fatty layers is seen. The glands vary in size; many were much larger than those in the other groups, so that no attempt was made to demonstrate the relative size of the glands on the diagrams.

## THE LYMPH-NODES IN CARCINOMA OF RECTUM

*Group 2.*—There were thirty patients (30 per cent.) in this group. Seventeen were males and thirteen were females. The average age was forty-eight and six-tenths years and the average duration of symptoms was eleven and

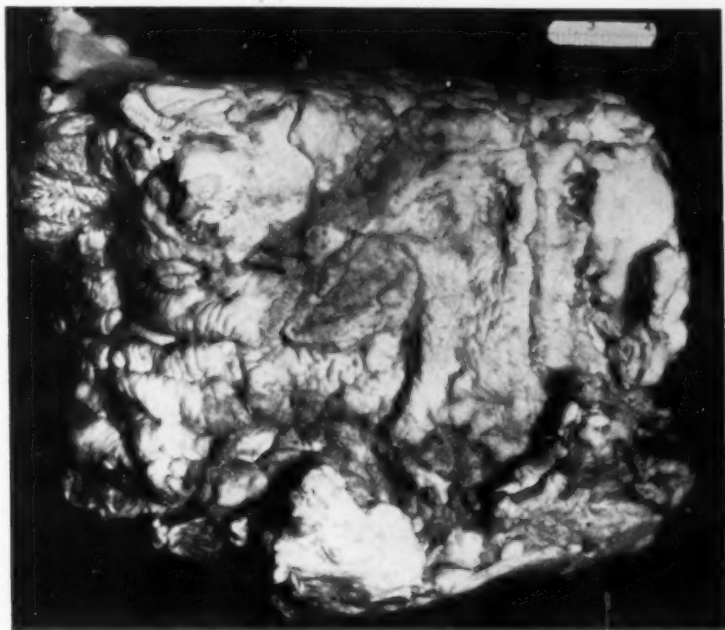


FIG. 8.—(Case A121346.) Typical specimen of Group 3.



FIG. 9.—Longitudinal section of growth shown in Figure 8.

one-tenth months. The average number of glands for each specimen was six and five-tenths. The sex, age, duration of symptoms, number of glands found, and number of glands involved in each specimen are shown in Table III.



The photographs of this group (Figs. 4 and 5) also show that the size of the growth bears no direct relation to the amount of glandular involvement (Fig. 6). The protuberant type of growth occurred less often; most of the growths showed excavated ulcers. The growths showed a tendency to grow into the muscular tissue and the fatty tissue around the bowel wall, and thus to disseminate by direct extension. The gland or glands usually involved are those nearest the point of greatest direct extension. In other

words, the metastasis is slow and the microscopic pictures show that the majority of the cells in most of the affected nodes, as seen in Figure 7, reach the state of secondary cyto-differentiation.<sup>11</sup> In many of the involved glands the cells are arranged in acinar form and in some this differentiation is advanced to the point of mucous production. This can only happen if the migration of the cells is slow and the tendency to return to the original type is strong.

*Group 3.*—There were seventeen patients (17 per cent.) in this group. Ten were males and seven were females. This is about the average for the entire series, so that sex apparently does not play a part in determining malignancy. The average age was fifty-one and two-tenths years and this also seems to show that the age does not determine malignancy to any great extent. It is true in carcinoma of the rectum as in all carcinomas in the body, that the most malignant types of growth

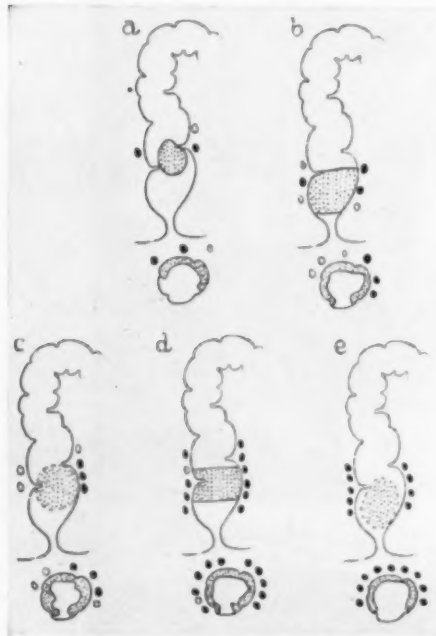


FIG. 10.—Diagram showing relative position of glands and growth in five cases of Group 3. Glands not involved are shown as clear circles; glands involved are shown in solid black. *a* (Case A110220). Encircling growth measuring 40 by 30 mm.; 9 cm. from anus. *b* (Case A121346). Encircling growth measuring 70 by 50 mm.; 5 cm. from anus. *c* (Case A139873). Growth on anterior wall measuring 80 by 60 mm.; 7 cm. from anus. *d* (Case A168690). Encircling growth measuring 55 by 60 mm.; 7 cm. from anus. *e* (Case A217336). Growth on anterior wall measuring 35 by 40 mm.; 3 cm. from anus.

occur in very young persons. The average duration of symptoms was seven and four-tenths months, which is almost four months less than the average for the other groups. While this group is too small for definite conclusions to be drawn, it would seem to show that in the more rapidly growing types the symptoms are such as to cause patients to seek medical advice earlier. The average number of glands for each specimen was six and one-tenth. Table IV gives the sex, age, duration of symptoms, total number of glands found and total number of glands involved for each specimen in the group.

The characteristic type of growth in Group 3 is seen to be the ulcerative (Figs. 8 and 9) and most of the growths were much smaller than the average of Group 1. The specimens (Fig. 9) resembled the growths in Group 2 in breaking through the muscular coats of the bowel, but their dissemination

## THE LYMPH-NODES IN CARCINOMA OF RECTUM

into the fatty tissue surrounding the bowel was much less. Metastasis occurs early to the nodes (Figs. 10 and 11) before direct extension far into the surrounding tissues has taken place.

Early glandular involvement affects so small a part of the gland that it can only be ascertained by microscopic examination. The lymph sinuses at the edge of the gland are first affected (Fig. 12).

Smith says, "There is need for further investigation on this subject (speaking of glandular involvement in carcinoma of the rectum), but I think sections of all glands from a series of rectal growths would prove that

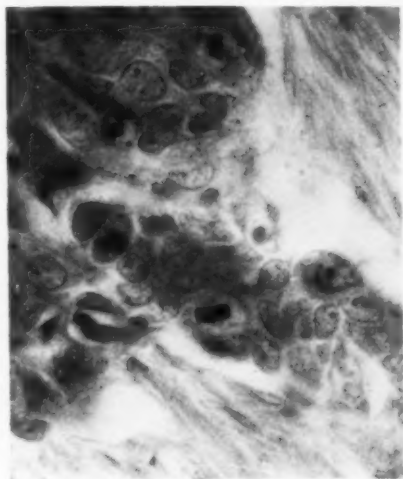


FIG. 11.—(Case A85834.) Metastasis in lymph-node. First degree of cytodifferentiation. Cells have large, clear nuclei with prominent nucleoli; two mitotic figures may be seen (X500).

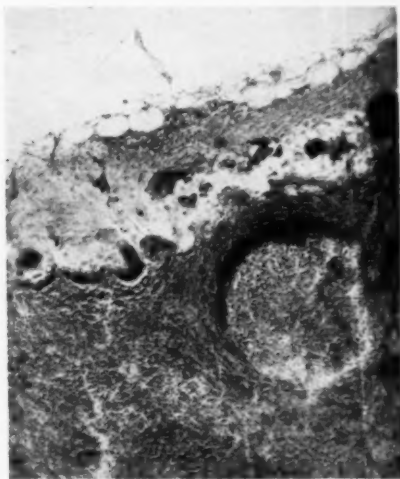


FIG. 12.—(Case A110220). Beginning involvement in peripheral lymph sinus, which could be determined by microscopic examination only (X50).

glandular invasion is not widespread in the stages early enough to be operable." This statement, based on clinical experience, is partially borne out by this study. Fifty-three per cent. of the patients did not have involvement of the glands, 30 per cent. had partial involvement, and 17 per cent. had marked involvement. Oehler reports that 38 per cent. of the fifty-four patients who died from carcinoma of the rectum and on whom necropsies were performed had glandular involvement in the retroperitoneal lymph-nodes. In Pennington's collected cases, 32 per cent. showed some involvement of the regional lymph-nodes. In neither instance was it stated that all the nodes were systematically examined. MacCarty and Blackford found 52 per cent. of 200 patients with carcinoma of the stomach to have glandular involvement. The close agreement of their percentages for the stomach and of those presented in this paper for the rectum is striking. It may mean that about one-half of the growths of the gastro-intestinal tract give rise to metastatic glandular involvement.

A systematic examination of the glands affords a more accurate idea of the prognosis in a given case. In studying the glands in Case A80564 (Fig. 7), the following note was made: Sections show but little evidence of differen-

JAMES ROBERT McVAY

tiation; the tumor should be rapidly growing. One should expect a short history and a poor result. When the history of the patient was consulted later, it was found that the symptoms had been present only six weeks. Operation was performed by the Mayo-Kraske method and the growth entirely removed. The patient returned to the Clinic six months later, and it was found that the disease had metastasized to the liver. He died shortly afterwards. The question of operability is often clinical, but the question of prognosis, aside from operative prognosis, is one which can only be accurately and safely answered by the aid of the microscope.

TABLE I  
*Distribution in Decades of the 100 Cases of Carcinoma of the Rectum*

Age		Patients
21 to 30 years	(29, 29, 30)	3
31 to 40 years		12
41 to 50 years		22
51 to 60 years		47
61 to 70 years		15
71 to 80 years	(79)	1
Total		100

TABLE II  
*Group 1. Cases of Carcinoma of the Rectum Without Metastatic Involvement of the Lymph-nodes*

Case	Sex	Age	Duration of symptoms, months	Glands dissected out	Case	Sex	Age	Duration of symptoms, months	Glands dissected out
669-½J	F	50	(?)	6	A120405	F	47	12	10
A2252	F	53	5	2	A121876	M	54	15	6
A3663	F	34	11	2	A123863	F	61	12	10
A7676	F	46	6	10	A124529	M	55	24	11
A7769	M	42	4	8	A132394	M	55	18	4
A8928	F	41	3	6	A136043	M	69	24	7
A715	F	58	12	5	A138027	F	51	4	3
A1484	F	53	36	5	A142982	F	47	36	1
A6354	F	54	8	3	A147264	F	67	3	2
A25364	F	61	12	2	A148799	M	69	5	11
A26283	F	70	(?)	6	A154180	M	34	12	4
A43441	F	57	12	9	A157347	M	54	12	7
A47322	F	53	18	10	A163565	M	43	24	10
A57201	F	51	10	9	A170796	M	57	8	4
A68756	M	51	12	1	A179420	M	48	36	9
A70580	F	56	3	7	A189827	M	55	11	7
A70730	M	53	12	5	A198743	F	53	3	4
A81871	M	52	7	4	A200441	F	38	5	6
A97023	M	60	18	3	A204879	M	57	13	9
A100372	M	50	12	12	A208438	M	44	3	5
A102258	M	45	6	5	A212669	F	40	24	5
A103155	M	64	12	6	A216300	M	39	9	4
A104886	M	46	8	11	A216842	M	43	7	7
A107782	M	44	4	4	A215439	M	51	12	4
A111786	M	50	12	10	A251281	M	54	3	5
A113133	F	51	12	9	A250263	M	54	7	2
A113219	M	53	12	6					

# THE LYMPH-NODES IN CARCINOMA OF RECTUM

TABLE III

Group 2. Cases of Carcinoma of the Rectum With Metastatic Involvement of Less Than One-half of the Lymph-nodes

Case	Sex	Age	Duration of symptoms, months	Glands dissected out	Glands involved
A19499	M	36	3	3	1
A26781	F	52	7	3	1
A43021	F	30	12	7	2
A44196	M	66	2	9	1
A47912	M	39	12	7	1
A64157	M	29	36	5	1
A66903	F	53	10	7	1
A69046	M	59	9	8	2
A73143	F	68	3	9	2
A79532	M	48	24	7	1
A80562	M	56	1.5	8	1
A99562	F	45	6	5	2
A101064	F	53	9	5	2
A109751	F	59	10	7	1
A159369	F	38	24	8	1
A164471	F	58	18	8	3
A166175	M	50	2	7	2
A168277	F	52	5 (?)	5	2
A169130	M	58	12	11	3
A169140	F	56	24	6	1
A174098	M	42	18	7	1
A174591	M	60	12	6	1
A176669	M	51	12	9	2
A185201	F	40	12	10	3
A187873	M	59	9	5	1
A201505	F	51	12	4	1
A250973	M	79	3	4	1
A2360	M	63	8	5	1
A5092	M	56	6	6	1
A69290	M	66	12	6	1

TABLE IV

Group 3. Cases of Carcinoma of the Rectum With Metastatic Involvement of One-half or More Than One-half of the Lymph-nodes

Case	Sex	Age	Duration of symptoms, months	Glands dissected out	Glands involved
928M	F	69	3	2	2
4831-1/2J	M	50	6	5	4
A7039	F	65	24	7	7
A7624	F	64	8	5	3
A7631	F	60	12	5	3
A21961	M	33	4	5	5
A23639	M	54	5	6	3
A52248	M	54	3	6	3
A74532	F	43	36	12	6
A78911	M	39	3	8	7
A85834	M	56	4	4	2
A108406	M	55	7	5	3
A110220	M	64	1.5	3	2
A121346	F	29	6	6	3
A139873	M	60	2.5	6	3
A168690	M	40	1.5	11	10
A217336	F	36	1.7	9	9

SUMMARY

Rectal carcinomas are the most common form of intestinal neoplasms and make up 4 per cent. of all the cancers of the body. The majority of patients are in the sixth decade. The males predominate slightly. The location of the growth on the rectal wall varies. About as many occupy the anterior wall as the posterior. The greater number of the growths are from the ampulla to the rectosigmoidal juncture. Adenocarcinoma is the most common type. Metastasis to the glands usually takes place slowly and the liver is the organ most affected by secondary growths. The other organs of the body are only rarely affected.

The size of the growth in the rectum cannot be relied on as an accurate index of the probable lymphatic involvement. The growths without lymphatic involvement tend to grow into the lumen of the bowel. The growths with slight lymphatic involvement tend to spread by direct extension and are slow growing. Carcinomas of the rectum with extensive lymph-glandular involvement tend to metastasize through the lymph-stream early. Occasionally metastasis may take place by emboli breaking off into the portal veins.

Metastatic lymph-glandular involvement can only be definitely determined by systematic microscopic study of all the regional lymph-nodes. The size of the lymph-node is not an efficient means of determining whether or not there is metastatic involvement. This is especially true if the amount of involvement is small, or if the process is an early one.

Systematic microscopic examination of all the regional lymph-nodes in carcinoma of the rectum offers, as it does in cancer of the stomach, the best method of establishing an accurate prognosis for the case.

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## SOLID CARCINOMA OF THE OVARY\*

BY MERLE R. HOON, M.D.

OF ROCHESTER, MINNESOTA

FELLOW IN SURGERY, MAYO FOUNDATION

THIRTY-SEVEN cases of solid carcinoma and two cases of solid sarcoma of the ovaries were found in the examination of malignant tumors of the ovary at the Mayo Clinic between January 1, 1910, and August 1, 1921. These tumors were solid throughout or contained only relatively small cysts, due to degeneration and necrosis or retention. All cases of benign or malignant ovarian cysts, dermoids, and so forth, were excluded. During this time there were 4175 tumors of the ovary removed. Thus, solid malignant tumors comprise 0.93 per cent. of all ovarian tumors. During the same period 540 malignant ovarian tumors were removed; of these 0.086 per cent. were solid. These tumors are referred to in the literature as Krukenberg tumors following the publication of his paper in 1896.

In Major's fifty-five collected cases the average age of the patients was thirty-six years. In the Mayo Clinic series the average age was 44.2 years. Two patients were eight and sixteen years of age, respectively. Three were between twenty-one and thirty, seven between thirty-one and forty, ten between forty-one and fifty, fourteen between fifty-one and sixty, and one was sixty-six. Twenty-six patients were married and four were widowed. Twenty-four of these had from one to nine children each. Seven of the patients were single.

The most common symptoms were pain, tumor, ascites, loss in weight and strength, anorexia, and disturbances of the bladder and rectum. Pain, which was present in thirty patients, varied in type and location. As a rule, it was located in the lower abdomen and pelvis, but occasionally it occurred in the lumbar or sacral region of the back and radiated down the groin. It was usually described as a constant dull ache, bearing down or dragging. Occasionally it was sharp and severe, due to twisting of the pedicle, when it resembled the colic of a renal or ureteral calculus. Twenty-two of the patients complained of tumors. Twenty of the patients had themselves discovered the tumor, seven were discovered by the family physician, and ten were not discovered until the time of examination at the Clinic. This failure to recognize the tumor in ten instances illustrates the importance of a routine complete physical examination.

Thirteen patients (35 per cent.) had ascites varying from 250 c.c. to 6 or 7 litres. Seventeen patients were past the menopause from one to sixteen years. Four had prolongation of the period and increase in the

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## SOLID CARCINOMA OF THE OVARY

menstrual flow, and ten gave histories of metrorrhagia of two months' to two years' duration. Seven had noticed irregularity in their periods.

Only two patients said that their general health was good. Twenty-two said it was below normal and thirteen that it was poor. Sixteen patients had normal appetites, fifteen had partial loss of appetite, and six had little or no appetite. Eighteen patients had lost from five to thirty-six pounds in weight; five were markedly cachectic. Seventeen complained of frequency, burning, or painful urination, and more or less continuous sensation of pressure, dragging, or weight in the bladder. One patient had had incontinence for six months due to the pressure of a large tumor. Sixteen patients complained of constipation and four of these had a sensation of fulness in the rectum with pain on defecation.

Physical examination of the patient reveals the presense of tumor, usually in the pelvis, often extending above the brim of the pelvis, and at times almost filling the entire abdomen. Fixation in such cases may be due to extension of the growth to the pelvic wall or adjacent viscera or to inflammatory adhesions. The blood picture shows varying degrees of secondary anemia as is seen in malignancy in other parts of the body.

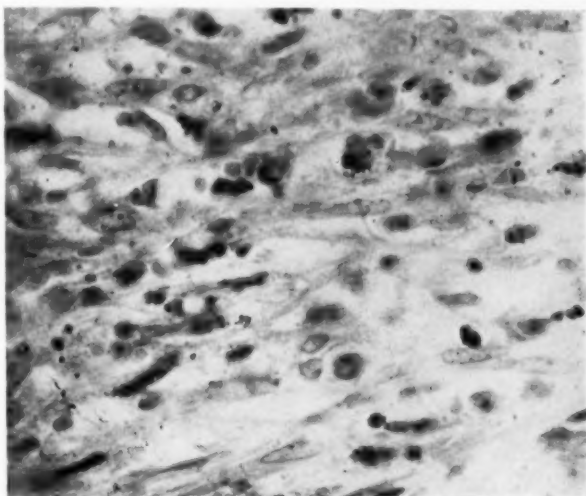


FIG. 1.—Melanotic carcinoma. Pigment lying within and between the cells. Marked absence of cell polarity. Prominent nucleoli (X 500).

On bimanual examination of twenty-three of the thirty-seven patients the tumor seemed to be nodular, and in three, smooth. In the others the type was not noted. In seven patients the tumors were fixed, in the others more or less movable. The apparent consistency of the tumors varied considerably; it was usually recorded as "firm or rather hard," and occasionally "stony hard." In two the examiner had believed the tumor to be cystic.

*Diagnosis.*—The clinical diagnosis of solid carcinoma of the ovary is rarely, if ever, made definitely. As a rule the surgeon must wait for the microscopic diagnosis by the pathologist. The differential diagnosis includes the consideration of benign and malignant ovarian cysts, ovarian fibromas and dermoids, fibromas of the uterus, retroperitoneal tumors, and tumors of a displaced kidney. The pre-operative diagnoses in the thirty-seven cases were: Ovarian carcinoma in ten, ovarian cyst in five, dermoid cyst of the ovary in one, uterine fibroma in seven, pelvic tumor in seven, uterine fibroma with carcinoma of the fundus in five, retroperitoneal sarcoma in one, and carcinoma of the stomach with pelvic tumor in one.

*Treatment.*—The treatment for this condition is the same as for any other type of ovarian malignancy, namely, surgical and radiologic. Exploratory operation should be offered to all patients, even in the presence of ascites, unless metastasis can be definitely demonstrated. Palpation of an enlarged nodular liver with umbilicated nodules on the surface, enlarged hard inguinal or pelvic glands, or extension with induration of the broad ligaments would indicate a condition hopeless of relief through operation. Röntgenograms of the chest and pelvic bones may make it possible to detect metastasis to these regions. In such cases radium and the Röntgen-ray may temporarily relieve the pain and suffering and prolong the patient's life for a short time. Periodic abdominal paracentesis may be necessary on account of re-accumulation of fluid.

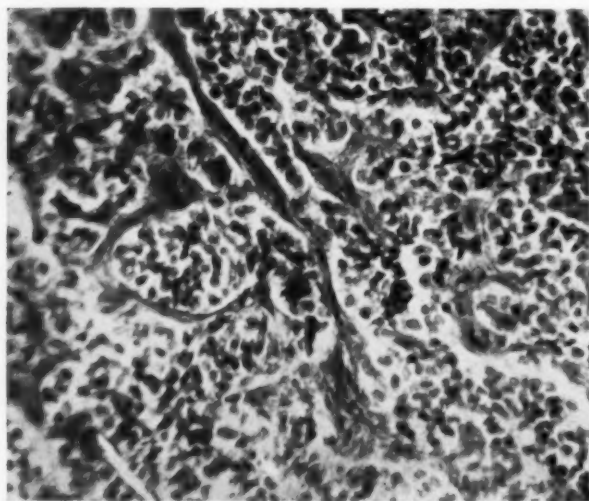


FIG. 2.—Solid carcinoma, Grade 4. No tendency to cell differentiation or gland formation; no polarity (X 200).

In cases amenable to surgery, post-operative applications of radium in the vagina and rectum, and Röntgen-ray applications to the abdomen and back, are of value, if recurrence is to be feared on account of the inability to remove all the malignant tissue. When recurrence takes place, radium and Rönt-

gen-ray offer little even as palliative measures.

If the patient's general condition permits, the ovaries, tubes, and uterus should be removed at operation, unless the tumor is definitely encapsulated and limited to one ovary of a patient who is in the child-bearing period and anxious to bear children. In nineteen patients of the series, hysterectomy, either total or supravaginal, with removal of both tubes and ovaries, was performed. The ovaries and tubes were removed in eleven patients and one tube and one ovary in seven. In the one case in which both ovaries were affected and the patient also had inoperable carcinoma of the stomach, both ovarian tumors were removed on account of the danger of twisted pedicles.

*Data from Patients Traced.*—Subsequent data were obtained from thirty-seven patients by reëxamination at the Clinic, questionnaires, or letters from the home physicians. Three of these patients were operated on a second time at the Clinic for recurrences. One of these returned four months later complaining of severe neuralgic pain down the right leg. This was found to be due to advanced involvement of the inguinal glands, which were removed with partial relief. Another returned at about the same interval

## SOLID CARCINOMA OF THE OVARY

with ascites and tumors of the omentum. The largest tumors were removed and Röntgen-ray and radium treatments were given. This patient lived eight months following the second operation. The third patient returned three months after operation with a small tumor on the skull, which proved to be carcinoma.

This series of cases indicates clearly that the so-called Krukenberg tumor, or solid carcinoma of the ovary, is often primary in the ovary. One case in the series, and a review of the literature, indicate that the ovary may be the site of tumor which is secondary to a malignant growth in the stomach or elsewhere. The case was diagnosed clinically as inoperable carcinoma of the stomach, and pelvic tumors. The patient gave a history of severe pelvic pain and insisted on an exploratory operation. An inoperable prepyloric carcinomatous ulcer was found which had penetrated the serosa and was attached to the pancreas. Rosenstein has called attention to the fact that it is not necessary for carcinoma of the stomach to penetrate the gastric serosa before metastasis may occur in the pelvis. In this case both ovaries were affected, and consequently removed; the right ovary weighed 950 gm. and the left 500 gm. Microscopic examination showed carcinoma with considerable fibrous tissue.

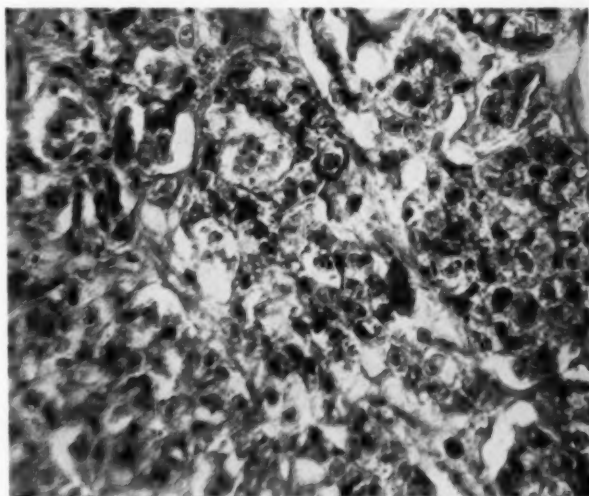


FIG. 3.—Carcinoma, Grade 3. Very slight cell differentiation with a slight tendency to gland formation (X 200).

In one case partial gastrectomy was performed in July, 1909, for carcinomatous ulcer on the lesser curvature. In February, 1912, both ovaries were removed; they were carcinomatous. No other evidence of involvement could be demonstrated at the time of operation, in spite of careful examination of the abdomen. The patient died from recurrence in the pelvis within eight months. In one case a Billroth operation No. 2 was performed for carcinoma of the stomach in June, 1910. In December, 1912, both ovaries were removed. Microscopic examination revealed carcinoma. Death occurred eight months later from recurrence in the abdomen. The last two cases are similar to a case reported by Hüsey in which the ovarian carcinoma occurred five years after operation for carcinoma of the pylorus.

In one case the ovaries and the gall-bladder were removed in February, 1913. The left ovary revealed carcinoma and the right ovary was normal. The gall-bladder contained many stones, and was chronically inflamed and



trabeculated. This patient died six and one-half years later, from carcinoma of the stomach. In one case a squamous-cell epithelioma was removed from the nose in 1912. Four years later the ovaries, tubes, and uterus were removed. All the organs were carcinomatous. The operation was difficult, because of marked local extension and numerous inflammatory adhesions between the tumors and the intestines. This patient died five days after operation. Necropsy showed metastasis to the left lung, but the stomach and other viscera were normal.

*Discussion of Findings.*—In one case a solid ovarian carcinoma was associated with carcinoma of the stomach. In two cases carcinoma of the ovaries

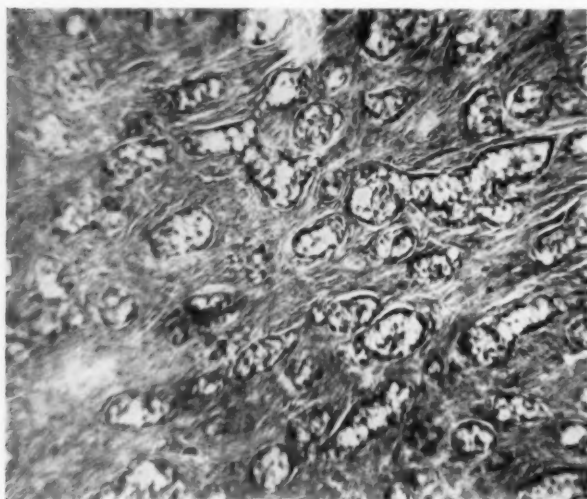


FIG. 4.—Carcinoma, Grade 2. Cells fairly well differentiated with gland formation. Migration of cells limited in degree (X 200).

was found two and one-half years after operation for carcinoma of the stomach. A fourth patient died from gastric carcinoma six and one-half years after both ovaries had been removed for carcinoma. In the first case there seemed to be a definite relationship between the carcinoma of the stomach and the solid carcinoma of the ovary. The time element in the second and third cases makes the relationship

questionable. In the fourth case the ovarian malignancy preceded that in the stomach by six and one-half years and any relationship between the two may be doubted.

*Type of Tumors.*—The tumors varied in size from 5 to 35 cm. in diameter. The weight varied from 30 gm. to 11,000 gm.; their average weight was approximately 1250 gm. In the heavier tumors calcification was marked, their consistency being almost stony. In twenty-four cases (65 per cent.) the involvement was unilateral and in thirteen bilateral. This is contrary to the usual findings in the literature, that the tumor is nearly always bilateral, which are used in the argument that bilateral involvement in organs, such as the kidneys and ovaries, in most instances indicates a primary growth in some other organ.

The shape of the tumors corresponded roughly to that of the normal organ. The surfaces were usually somewhat nodular and spotted with many small cysts 1 to 7 or 8 mm. in diameter. The consistency varied according to the degree of degeneration, necrosis, and calcium deposit. In the

## SOLID CARCINOMA OF THE OVARY

large tumors necrosis was marked on account of the poor blood and lymph supply in the centre of the growth.

In the microscopic study of these tumors an attempt was made to classify the degree of malignancy into four groups, based on MacCarty's primary, secondary, and tertiary cellular differentiation and Broder's method of the classification of epitheliomas into Grades 1, 2, 3 and 4. The higher the degree of differentiation and specialization of cells, or the greater the tendency towards the adult type, the less malignant was the growth. Conversely, the less the differentiation and specialization or tendency towards the embryonic cells, the more malignant.

In the twelve tumors classified as Grade 4, no attempt was made at cell differentiation and gland formation. Four of the patients are known to be living and well, ten months, eighteen months, five and one-half years, and nine years, respectively, after operation. In the eight cases death

occurred from recurrence within from two to sixteen months after operation. The average interval was six and one-fourth months. One of the patients had melanocarcinoma.

Broders and MacCarty have called attention to the fact that the terms melanosarcoma, melanoma, melanotic sarcoma, chromatophoroma, and so forth, are misnomers. They have given good reasons why the pigmented malignant neoplasms arising in the skin, choroid, and other parts of the body should be called melano-epitheliomas. Cottam and Herzberg reported a case similar to the one of melanocarcinoma in this series. Their patient was thirty-eight years of age. They were unable to demonstrate metastasis or recurrence one month after operation, but gave a bad prognosis. Winternitz reported a case of a patient aged twenty-six years, whose growth he regarded as primary in the right ovary. The patient had cerebral metastasis for which operation had been performed by Cushing three months before discovery of the pelvic tumor. Andrews has reported a case of primary so-called melanotic sarcoma of the right ovary in a patient four months pregnant; the growth was removed. The left ovary was normal.

In the fourteen growths of Grade 3, microscopic examination showed little differentiation of the cells. In places there was a slight tendency to gland formation. Four of the patients are known to be living and well, two, three,

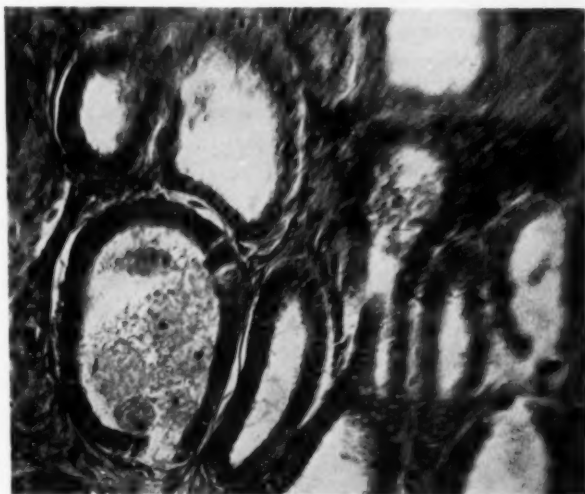


FIG. 5.—Carcinoma, Grade 1. Cells comparatively well differentiated with gland formation. Migration of cells in occasional areas (X 200).

five and one-half, and seven and one-half years after operation. One patient died five days after operation. The other nine died in from two and one-half to twenty-one months after operation. The average interval between operation and death was eight and one-half months.

In the ten growths of Grade 2 microscopic sections showed the cells to be partially differentiated and forming glands. The cells of some contained mucus, and showed varying degrees of migration. It was impossible to trace one patient. The other eight died in from four to fifty months after operation, the average post-operative life being fifteen months.

In only one case was the growth graded 1. Microscopic examination showed comparatively well-differentiated cells. The cells showed only a

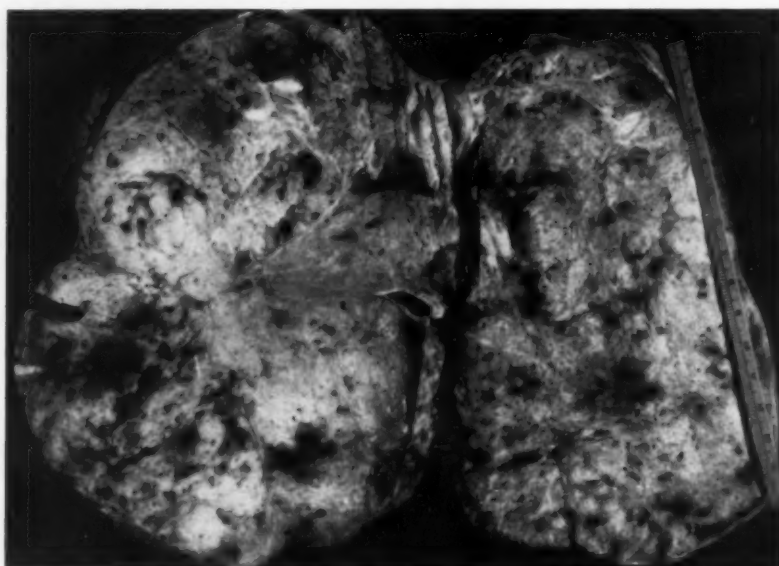


FIG. 6.—Carcinoma of the ovary in a child aged eight years. Specimen 20 by 14 by 9 cm.; cut surface.

slight tendency to migrate. The patient was alive and well two years after operation; she had gained eight pounds.

Of the thirty-seven cases twenty-six (70 per cent.) were graded 3 and 4 by microscopic examination. This bears out the clinical histories and shows that solid carcinoma of the ovary is highly malignant. Broders estimates that 75 per cent. of epitheliomas of the cervix fall into Grades 3 and 4. Thus, solid carcinoma of the ovary is only a little less malignant than that of the cervix.

The prognosis in solid carcinoma of the ovaries is comparatively poor. Formerly this tumor was believed to be relatively benign, but all the recent writers agree that it is more malignant than previous reports indicate. In this series only three patients were living and well after the five-year period, five and one-half, seven and one-half, and nine years, respectively, after operation. Two were living and well after three years, two after two years, two

## SOLID CARCINOMA OF THE OVARY

after eighteen months, and two after ten months. In contrast to these eleven patients six were dead within six months, nine within one year, and four within two years.

### CONCLUSIONS

1. Solid carcinoma of the ovary may occur at any period of life from childhood to senility, the most common period being in the fourth and fifth decades.

2. The tumors are highly malignant and are more often primary than the recent literature indicates.

3. Solid carcinoma of the ovary may be bilateral, but in 66 per cent. of the cases the tumor was unilateral.

4. Melanotic carcinoma is occasionally primary in the ovary.

5. Melanotic carcinoma of the ovary is highly malignant, as is the same type of tumor elsewhere.

6. The general history is similar to that of ovarian fibroma with the additional symptoms of malignancy, loss in weight, strength, and appetite, and secondary anæmia. The growth of the tumor is usually rapid.

7. Ascites cannot be considered a criterion of malignancy, as it was present in 35 per cent. of the solid carcinomas and in 25 per cent. of the benign fibromas.

8. The treatment of solid carcinoma of the ovary is surgical removal followed by Röntgen-ray and radium, if total removal of malignant tissue is impossible.

9. Metastasis and local recurrence indicate a hopeless prognosis, but palliative treatment may be given by radium and the Röntgen-ray.

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## DOUBLE LIP

BY GEORGE M. DORRANCE, M.D.

OF PHILADELPHIA, PA.

DOUBLE lip may be present as a congenital deformity. It is usually seen after the eruption of the permanent teeth. I have never seen it develop in patients after twenty-one years of age.

The illustrations (Figs. 1, 2, 3) show a well-developed double lip in the case of a man aged twenty-one years, who states this condition has been

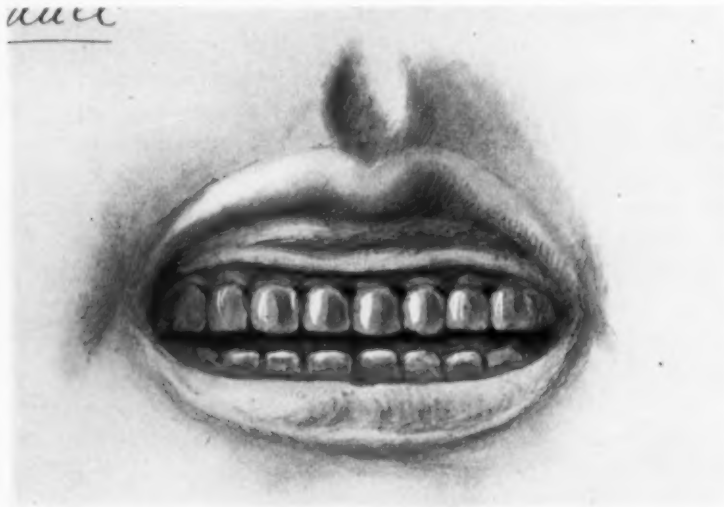


FIG. 1.—Double lip.

present since he was twelve years of age. There is, as shown in the illustration, a redundancy of the mucous membrane starting about one centimetre from the level of the labial alveolar sulcus. The submucous tissue is always in excess. The labial glands are enlarged. The condition is unsightly and frequently interferes with the speech. The only method for correcting this condition is surgical removal. The anæsthetic of choice is local anæsthesia.

The incision is begun at the labial alveolar sulcus immediately above the second bicuspid tooth and extends along the sulcus to the second bicuspid on the opposite side. A second incision is made, starting at the same point. This incision is made in the form of a crescent, as shown in illustration number two, and is completed by joining the termination of the incision on the opposite side. The redundant mucous membrane, submucous tissue and the labial glands in this area are excised. The frenum is necessarily divided.



## DOUBLE LIP

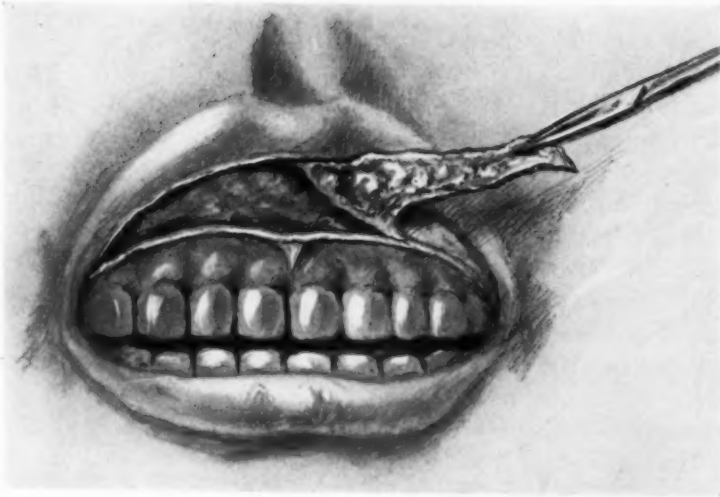


FIG. 2.—Removal of the redundant mucosa.

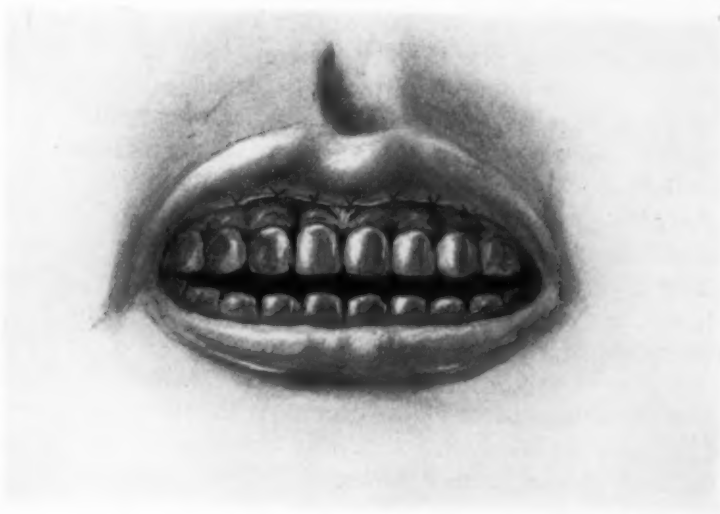


FIG. 3.—Completed operation.

## SUBMAXILLARY SALIVARY CALCULUS\*

By B. FRANKLIN BUZBY, M.D.

OF PHILADELPHIA, PA.

SALIVARY calculus, although comparatively frequently encountered, still goes unrecognized in a great many instances, and I feel that it is of sufficient importance to briefly review the causes, the usual symptoms, and the diagnosis and treatment.

The literature contains many case reports from all parts of the world, and all are agreed, that, like calculus formation in the gall-bladder, kidney and urinary bladder, a nidus is present which in the mouth can be composed of bacteria, food particles, cellular detritus and inspissated saliva. Then in the growth of the stone all of the inorganic salts (phosphates and carbonates of potassium, calcium and magnesium) present in the saliva can become crystallized out and laid down around the foreign material as a centre. The reason perhaps that the submaxillary gland is more frequently the seat of calculus formation than the others, estimated at 75 per cent. of all, is that the saliva from this gland is more viscid and more concentrated and therefore there are more salts which, because of the high viscosity, become crystalline more easily.

Primary infection followed by calculus formation may explain some of the cases, but this history is difficult to elicit as a rule. Carious teeth have been ascribed as a possible cause. Most sufferers seem to be in the third and fourth decades of life, although cases are reported in children and in the elderly. Males seem to be more frequently affected than females, explainable perhaps because infection of the mouth is more common in men or perhaps because of the use of tobacco.

The size of the calculus varies greatly, depending on its location. They are apt to become very large in the gland itself up to three cm. in diameter and weighing up to fifteen gms., without causing any deleterious symptoms, whereas in the duct, stones as small as two mm. in diameter can cause typical symptoms, the whole process being dependent upon obstruction. The stones as a rule are gray or yellow in color, rough on the surface, and in the gland are irregular in outline, while in the duct they are spherical or cylindrical. An occasional case has been noted with more than one calculus present; still, most of the cases present solitary stones.

The history as a rule is typical, especially where the stone is in the duct. The patient complains of a very painful and tender sudden swelling in the region of the affected gland appearing coincidentally with mastication or other causes of increased salivary flow. This gradually disappears in from fifteen minutes to two hours after the causative agent has passed. This painful swelling, because of increased tension in the mouth, interferes greatly with the

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\* Read before the Philadelphia Academy of Surgery, May 8, 1922.

## SUBMAXILLARY SALIVARY CALCULUS

movements of the tongue and deglutition. Talking also is painful, due again to tongue motion. This type of history is indicative of a stone in the duct acting as a sort of ball valve and causing a partial obstruction to the salivary flow, the gradual relief of which is coincident with the disappearing pain and swelling.

The history of a stone in the gland itself is different. There is no intermittent swelling, but instead a very slowly but steadily growing painful and tender tumor at the site of the involved gland, not influenced by the flow of saliva, although muscular action in eating may cause pain from pressure on the enlarged gland.

The diagnosis is not difficult, although rather important. Bearing the history in mind, if a bidigital examination is made with the finger on the outside pressing upward on the gland, and if the finger inside the mouth is brought forward along the course of Wharton's duct from opposite the lower molar tooth, a hard superficial shot-like body is encountered, which is especially tender on pressure. This is the calculus.

In the case of the glandular stone an illy-defined hard structure will frequently be made out in the substance of the gland which is the calculus in this type. An X-ray picture taken of the area always shows the calculus, and if the examiner is unable to palpate this in the duct the location is in the gland. Glandular calculi may be multiple, while duct stones are usually solitary. If a small probe is passed into the duct, one is able to definitely localize the stone. Exploratory puncture of the gland has been recommended for definitely determining glandular calculi, although to my mind this seems unnecessary.

Differential diagnosis should be made from bone tumor and malignancy which should present no difficulties if a careful history and X-ray are taken. Submaxillary lymphadenitis should not cause confusion. Occasionally air tumors are encountered in this region. Inspissated mucus alone, constriction of the duct and chronic hypertrophy of the gland all might be mistaken for calculus formation also, but all could be ruled out by X-ray, passage of a probe and palpation.

The treatment consists in the removal of the stone when in the duct and at a time between attacks when the gland has resumed normal size and relations. This is done best under ether or chloroform anæsthesia, because under local anæsthesia the movements of the tongue, which cannot be controlled, greatly hamper the operator, and the severe pain caused by upward pressure on the gland necessary to render the duct more prominent, is almost unbearable to the patient. Then also the lingual nerve and maxillary and facial arteries are very close to the duct and are in danger of injury unless the patient is under complete control. A direct longitudinal incision down to the stone through the mucous membrane of the floor of the mouth and through the wall of the duct will give adequate exposure. The stone then can usually be lifted out with forceps. Occasionally the stone is mulberry like on the surface and is difficult to remove in this way, so it is necessary to

resort to shelling out the calculus with the finger. No sutures are necessary as an incision 1.5 cm. long is always ample. After-treatment consists in a bland mouth-wash used frequently, and daily irrigations of the wound with the same solution.

Occasionally by slitting the opening of the duct the calculus can be worked forward and out of the orifice without further incision. This method as a rule is contra-indicated unless the calculus is very near the papilla because of subsequent stricture of the duct incident to the trauma. Recurrences in the duct are rare.

Some of the complications are abscess formation in the affected gland, glossitis and sympathetic salivary adenitis, all of which should receive appropriate treatment should they arise.

Occasionally obstructive duct symptoms may occur because of multiple minute calculi as in Case II. These as a rule are ejected if the pressure of the saliva is great enough, and appear as a gritty, creamy admixture of pus, mucus and inorganic salts. This type of patient should be watched carefully for a growth of a larger calculus in the gland or duct.

If the calculus is in the gland the whole gland should be removed because of the pain and possible abscess formation. If the gland is enlarged and tender at all times, even though the stone be in the duct, it should be removed primarily; the same is true if the symptoms are of long standing and it is felt that there is some possible purulent infection in the gland. All cases of stone in the duct, however, should not have the gland removed, for frequently the gland resumes normal function after the stone is removed.

Should abscess formation supervene, as evidenced by redness, heat, cedema and possible fluctuation, external incision and drainage is indicated and later, after the acute symptoms have fully subsided, the gland should be removed.

CASE I.—T. F.; age, twenty-nine; white; male; married; ex-pugilist, and laborer by occupation at present.

*Previous History.*—Exposed to mustard and tear gas in July and November, 1918. Compound comminuted fracture left lower leg and multiple trunk wounds due to shell fragments in November, 1918, in Argonne forest. Fracture of left mandible in 1915. Uses cigarettes to excess.

On August 3, 1921, complained of a sudden oncoming soreness in the right submaxillary region, which was coincident with the intake of food. He had difficulty in swallowing and in talking, and complained of "thickness in his throat."

Upon being given a hard roll to eat, a swelling five cm. in diameter and elevated one cm., appeared promptly in the submaxillary region while masticating and disappeared within fifteen minutes after he stopped eating, after which bidigital examination revealed a tender submaxillary salivary gland on the right side, but of normal size. A shot-like immovable body, which was exquisitely tender on pressure, was felt opposite the third molar tooth on the right side. An X-ray showed a shadow 7 x 4 mm. in this plane. The removal of the calculus was attempted under local cocaine adrenalin anæsthesia, but failed due to inability to keep the patient's tongue out of the operative field and the pain incident to the upward pressure on the gland. One week later under ether an incision 1.5 cm. long was made longitudinally over the duct down to the stone, and it was removed.

## SUBMAXILLARY SALIVARY CALCULUS

The stone was of the size seen in the X-ray, was yellowish white in color and the surface mulberry-like. Convalescence was uneventful, but on October 24, 1921, all previous symptoms returned, suddenly as before, accompanied by fever and a moderate-sized tender swelling of the right submaxillary gland, which persisted between the intake of food but which was greatly increased by eating. He also had a bad taste in his mouth and flaky mucopurulent particles were extruded from the duct orifice. X-ray at this time was negative for stone. With these symptoms in view and the previous history it was decided to remove the entire gland at once, which was done by Dr. A. P. C. Ashhurst at the Episcopal Hospital with complete amelioration of all symptoms. The pathological report was "acute salivary adenitis. No calculi present."

CASE II.—L. C. E.; age, thirty-four; white; male; married, and a clerk by occupation. Previous history negative. Smokes cigars in moderation. On August 25, 1921, without previous discomfort and while eating lunch had a sudden severely painful swelling of the neck in the region of the left submaxillary gland so marked as to preclude finishing his lunch and accompanied by slight nausea. He was seen within a half hour of the onset with a grayish-white granular plug two mm. in diameter protruding from the orifice of Wharton's duct and a swelling of the left submaxillary gland fully as great as that shown in Fig. 1, B, which was exquisitely tender. This soft granular material was removed piecemeal and was followed by a gush of saliva from the duct in the affected side. The following day, while it was slightly tender, the gland was normal in size, and there were no masses palpable, neither along the duct nor in the gland itself. There was still a slight amount of detritus protruding from the duct orifice. No recurrence of symptoms has occurred since that time, and an X-ray taken on February 14, 1922, shows an indistinct shadow, roughly triangular in shape and about four mm. on a side located in the region of the submaxillary gland just posterior to the third molar tooth. In view of the absence of symptoms and the uncertainty of the X-ray findings, I feel further interference is unnecessary until further symptoms arise.



# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

*Stated Meeting Held March 22, 1922*

The President, DR. JOHN A. HARTWELL, in the Chair

## ARTHROTOMY FOR CHRONIC ARTHRITIS OF KNEE

DR. HAROLD NEUHOF presented a man forty-seven years of age, from the First Surgical Division, Bellevue Hospital, who was presented before the Society a year ago and is shown again because the question came up at that time as to what the ultimate result might be. In brief, he had been suffering from this monoarticular lesion of unknown origin for two and a half years before the time of operation, with pain and disability that were progressive despite active treatment by massage and baking, and extraction of teeth, etc., to attempt to eliminate foci of infection. The knee-joint was almost completely fixed, the range of motion being a very few degrees. Pain was severe and persistent so that the patient had been unable to attend to his work, involving standing for eight or ten hours a day, for several months. The X-ray picture was that of a chronic arthritis. Operation consisted in a long vertical curved incision mesial to the patella and lateral retraction of the patella after the joint was opened. There was pronounced thickening of the synovial membrane, many pedunculated fat masses, and some free fibrous bodies. Limitation of motion was found to be chiefly due to a broad fibrous band anterior to the crucial ligaments extending from the tibia to the intercondyloid portion of the femur. After this was excised the patella could be laterally drawn beyond the femur and the joint well flexed. The remainder of the operation consisted in the free removal of the fat masses and excess portions of the altered synovia. Passive motions were begun the day after operation and continued with increasing range. No other after-treatment was employed. When shown last year the range of motion was from  $100^{\circ}$  to  $180^{\circ}$ , no pain, and ability to continue his occupation. He has been able to work uninterruptedly and in comfort since that time, and now the range of motion is from  $85^{\circ}$  to  $180^{\circ}$ . Except for some dull ache in bad weather, there is no pain. He is a heavily built man, weighing 240 pounds, and is on his feet almost continuously from morning to night.

## LATE SUTURE OF BRACHIAL PLEXUS

A second case, presented by Dr. Harold Neuhoof, was a man, thirty-six years old, from the First Surgical Division, Bellevue Hospital, who six weeks previously had been stabbed in the left side of the neck. An active hemorrhage followed and he was taken to a hospital where an operation was performed for the control of bleeding. The patient noted

## LATE SUTURE OF BRACHIAL PLEXUS

paralysis of the arm directly after his injury, and this remained unchanged during the succeeding weeks. There was as well constant dull ache in the left shoulder and wrist, and numbness and tingling in the thumb and index fingers.

Upon examination there was a flaccid paralysis of the upper arm type, with marked atrophy of the shoulder and arm, and atrophy to a lesser degree of the forearm and thenar eminence. The deltoid, supra- and infra-spinati, biceps, and coracobrachialis were totally disabled, with the associated complete loss of abduction at the shoulder and flexion of the elbow. The teres minor appeared totally paralyzed, and the latissimus dorsi, subscapularis, brachialis anticus, and supinator longus were partially disabled. Biceps and radioperiosteal reflexes were absent. Sensation was lost over the shoulder in an area corresponding to the circumflex nerve and over the first two fingers and radial side of the hand in an area referable to the musculo-cutaneous and median nerves. Reaction of degeneration was present in the paralyzed muscles.

The lesion was clearly a complete one of the upper trunk of the brachial plexus a short distance beyond the junction of the fifth and sixth cervical nerves and apparently a partial one of the middle trunk. The question came up as to whether operation should be performed at so long a time after injury.

At operation, two months after the injury, considerable cicatricial tissue was found about the site of the divided upper trunk. The lesion was directly beyond the junction of the fifth and sixth roots. The divided ends were separated by about two cm. Normal nerve bundles were found after removal of about one cm. of scar tissue from each nerve end. The middle trunk presented a slight fusiform thickening with induration, but transmitted electrical stimuli. The divided ends were freely mobilized. The nerve ends were approximated by Carrel sutures passed between fasciculi, and the nerve sheaths by very fine catgut. There was no tension on the suture line with the head bent to the affected side and the shoulder elevated.

The result seen now, sixteen months after operation, can be largely ascribed to the energy with which the patient pursued the after-treatment. This consisted in wearing an abduction splint for several months after operation and in massage and, later, electrical stimulation three times a week. Six months after operation there was no sign of improvement in function. The atrophies were as marked as before operation, if not more so, and the reaction of degeneration was complete in the affected muscles. The patient, however, continued treatment regularly. The first sign of improvement was noted seven months after operation, when sensation began to return over the areas in which it had been lost. Ten months after operation there was slight power in the deltoid, fair power in flexion at the elbow, and the shoulder and arm were beginning to fill out. From that time on the improvement has been rapid. The patient is now able to pursue his occupation as a mechanic. There is excellent power in the deltoid, biceps, and coracobrachialis. The spinati and supinator longus show a lesser degree of recovery. Sensation is normal. Reflexes are lively. The

## NEW YORK SURGICAL SOCIETY

electrical contractility is approximately normal. Further improvement may be confidently anticipated.

### CRANIOTOMY FOR CONGENITAL CRANIOCEREBRAL DEFECT AND EPILEPSY

DOCTOR NEUHOF, in presenting the next two cases, stated that he had not seen any such abnormality described in the literature. Cranial gaps of congenital nature had been accidentally encountered, but apparently had not given rise to any manifestations. He had not found post-mortem or other examinations that might have indicated the existence of lesions beneath the skull. The pathological picture was similar but not identical in both cases.

In the first case, a boy, eighteen years old, from the Surgical Service of Doctor Lilienthal, Mount Sinai Hospital, had epileptic attacks which began about a year before operation. They were generalized and became progressively more frequent. The examination was negative except for the skull defect. It was indistinctly felt, but is clearly seen in the X-ray picture. This shows an almost circular defect about three by three cm. in the right anterior parietal region, with sharply outlined margins. The appearance is that of an operative removal of bone. Operation was performed, about two years ago, in the hope that some remediable lesion such as a cyst might be found beneath the skull defect. A large osteoplastic flap was made to include the abnormal bone area. As this was turned down the inner surface was found intimately attached to the underlying structures. The inner surface of the gap in the bone was partly covered by exceedingly thin shells of osseous tissue, for the most part measuring one by five-tenths cm. No normal dura was seen. This membrane was represented by a fibrous shreddy tissue in which additional bone flakes were embedded. Nor could the pia-arachnoid be recognized as such, a thin layer of opaque tissue being adherent to and obscuring the adjacent brain surface. This was flattened out as a whole, depressed, and the convolutions were small and insignificantly developed. Incorporated in them were several of the flaky bone fragments. These were removed by careful dissection. It was evident that no remediable lesion existed and the flap was therefore replaced and the wound closed. Epileptic seizures happen to have been less frequent and for the most part less severe since the time of operation, but there is of course no reason to believe that operation has been of any benefit.

### CRANIOTOMY AND FASCIAL TRANSPLANT FOR CONGENITAL CRANIOCEREBRAL DEFECT

The second case, a boy, seventeen years old, also from the Surgical Service of Doctor Lilienthal, Mount Sinai Hospital, gave a history of several injuries to the head without any immediate manifestations. The cranial gap cannot therefore be linked with trauma. He has had frontal headaches for several years and a gradually altering mental disposition. Its most striking aspect has been a frequently repeated depart-

## TRAUMATIC RUPTURE OF THE SPLEEN

ure from home from varying periods of days to weeks. Physical examination revealed no abnormality other than the cranial defect. This was a depressed area in the right posterior parietal region. The X-ray picture showed a clean-cut defect in the bone about two and a half by three cm. Operation performed in September, 1920, was done on the tentative diagnosis of a subcranial lesion with bone absorption. An osteoplastic flap was made with its base close to the mastoid, the involved bone being included in the flap. It was found greatly thinned, absent in places, and the tissues occupying the defect were soft enough to be cut with a knife. The rim of the defect was well defined below, shading off into the normal skull above. The dura was entirely gone over an area about two and a half by two and a half cm. The exposed brain surface was depressed, of bluish color and with bare traces of convolutions. Surrounding this area was an elevated, firmly infiltrated ring of brain cortex about one and five-tenths cm. wide, interpreted as sclerosis. The margins of the dura were freshened and a section of fascia lata about five by five cm., taken from near the knee, was sutured in place to cover the exposed brain. The flap was then returned and sutured in place after removal of the shreddy tissue occupying the skull defect. The microscopic examination of the removed fragments, in this as in the preceding case, showed degeneration and atrophy of bone and soft parts. Apparently headache and the mental condition have improved since operation. Considering what was done at operation and the operative findings this result can only be interpreted as a psychical effect of operation.

DR. A. V. MOSCHCOWITZ, in referring to the last case, said that within the last two months he was asked to see a child, a boy of five or six years of age, in the paediatric service of Mt. Sinai Hospital. This boy had a number of large defects in the skull, which could be palpated with the greatest ease. Almost everyone who saw the child made a diagnosis of congenital lues, but subsequently it was proven to be a case of a so-called "Lueckenschädel," and had nothing to do with lues.

DOCTOR NEUHOF, in closing, stated that of course the condition of cranial gap, termed "Lueckenschädel," had been reported a number of times. The defect is usually single but may be multiple. It is usually accidentally noted. But it has been previously shown, as far as he is aware, that the defect is not in the skull alone but apparently is a defect involving the cerebral coverings and the brain substance as well.

## TRAUMATIC RUPTURE OF THE SPLEEN

DR. JOHN F. CONNORS reported R. B., six years old, schoolboy, admitted to Harlem Hospital, January 28, 1922, with the following history: One-half hour before admission was struck by an automobile while attempting to cross the street. It was said that the front wheel passed over his body. The abdomen was distended, with pain in the epigastrium. Tenderness present all over, but most marked in the upper half. There is slight rigidity of the abdominal wall. No pain in shoulder.

The following morning he was apparently comfortable, but had some abdominal distention. He had vomited twice during the night. His temperature was normal, and pulse was 120. He presented a picture of one who had lost a great deal of blood, and a diagnosis of a ruptured spleen was made from the blood count, which showed his red blood count had been reduced from four to two million.

*Operation.*—An upper midline incision about three inches long was made. This was extended with a transverse incision to left from mid-portion of first incision. Free blood was found in the peritoneal cavity. On exposure of viscera, spleen was found to have a stellate rupture down to the hilus. Vessels ligated and spleen removed. On account of the condition of the child the abdominal wound was closed by through-and-through sutures of silk. Skin closed with catgut. Infusion of N/Saline attempted, but only a small amount of fluid injected. Later the same day 200 c.c. of blood from the mother was given.

This case is not presented because of its diagnosis or recovery, but rather to bring to mind the theory of Steubenrausch, as quoted by Michelson, who have seen cases operated upon one or more years after splenectomy, in which they found nodules scattered throughout the peritoneum, which showed characteristics of splenic tissue. These findings warrant the thought that small accessory spleens undergo hypertrophy and function in place of the missing organ. All of his cases of splenectomy for trauma were under eight years of age with one exception, and have passed through the diseases of childhood and are apparently in good physical condition. A case was reported a few days ago by one of his assistants upon whom he performed an autopsy on March 10, 1922. This patient died of influenza. In it he found a spleen three inches by one and one-quarter inches in the place where the organ should be. Just above this he found an aberrant spleen one inch in diameter, although this case had been splenectomized one year previously for Von Jaksch's anæmia.

#### ACUTE PANCREATITIS

This condition was illustrated by Doctor Connors in presenting the case of F. R., housewife, thirty-four, white, admitted to Harlem Hospital, November 4, 1921. Chief complaint, pain in right hypochondrium.

*Present History.*—Illness dates back to about six months ago, when she began to have attacks of pain in right hypochondrium followed by nausea and vomiting. Vomiting partially relieved pain. November 2, the patient had a similar attack which has continued to date. She complains of a pain in the hypochondrium which radiates to the back, nausea, and vomiting. For the past two days she has noticed that she is becoming yellow (no previous history of jaundice). No history of clay-colored stools. On the day of operation she was seized with a knife-like pain in the midline of the epigastrium which radiated to the back. She went into collapse with a marked cyanosis.

*Operation.*—Transverse incision, peritoneum opened, exposing duodenum, gall-bladder and liver. Gall-bladder filled with stones. Several



## ACUTE PANCREATITIS

stones in the cystic duct, but none in the common duct. The head of the pancreas was greatly enlarged and indurated in spots which were surrounded by areas of softening, but at no place could fluctuation be felt. The gall-bladder was removed and the common and hepatic ducts were opened, which were found to be free from stones. On account of the condition of the head of the pancreas a tube was sewn into the common duct for drainage purposes. The appendix was removed, although it appeared normal. The abdominal wall was closed by layers.

This patient had a very stormy convalescence. For five days she had a temperature ranging between 104 and 105° and was extremely ill. There was a great discharge of bile through the wound, but the stool induced by enemata was not the clay-colored stool one would expect to find, rather one that showed evidence of bile passing through. On the fifth day the stools were normal in color. She was transfused on the fifth day. On the tenth day, the tube was found on the dressing when it was removed. The amount of bile decreased daily until the sixteenth day, when she had another attack of pain in the hypogastrium and the wound opened spontaneously with a discharge of bile, which relieved the pain. During this time her jaundice completely disappeared. She remained well for two weeks, when her wound opened again with a discharge of bile which lasted for three days. Although the wound has remained closed and there has been no jaundice or clay-colored stools, nevertheless she has made very little progress until the last few weeks, when she has improved markedly, having gained twenty pounds in weight and presents no digestive symptoms. This case brings about the question of the cause of the condition found in the pancreas. The appearance of the gall-bladder and the pathological examination would not warrant the thought that it was caused from the biliary tract, for there was no difficulty in passing the probe into the duodenum. Therefore, it seems that one must look to the lymphatics as to the cause of her condition.

The classification of the pancreatic condition is an open question. The fact that at the time of operation they were unable to feel any distinct point of fluctuation points to the lymphangatic (non-suppurative) form of acute pancreatitis, as described by Deaver and Pfeiffer. In most cases of acute pancreatitis there are evidences of fat necrosis which did not appear in this case, and in most cases there is no jaundice, but when one considers that the common duct passes through the gland itself, and appreciating the size of this pancreas, one can easily explain the jaundice in this case.

DR. CHARLES E. FARR referred to a case he had seen with jaundice that came to autopsy in which there was complete necrosis of the pancreas. Another case, clinically pancreatitis, also had jaundice, but no operation nor autopsy was permitted. Both cases had definite cholecystitis and cholelithiasis.

DOCTOR CONNORS, in closing, admitted that there was a possibility of his having been mistaken, but the condition found in the gall-bladder on pathological examination showed it to be only slightly inflamed. There was nothing in the common bile duct nor in the hepatic duct. There was no area that

could be called fluctuation. No jaundice was present before operation and there was no fat necrosis.

#### EMBOLISM OF THE BRACHIAL ARTERY

DOCTOR CONNORS recited the case of a patient, a schoolboy, eleven years old, admitted to Harlem Hospital, December 8, 1921, with a diagnosis of compound fracture of the left humerus.

There was a wound on the flexor surface of the elbow with a marked deformity of the lower end of the humerus. He complains of numbness of the fingers of the left hand, which were cold and pale. However, he is able to move his fingers. At the elbow there is displacement, backward, with excessive motion, especially laterally. There is no definite crepitus, some swelling, no discoloration. The wrist shows a deformity of a Colles' fracture. The hand and arm are cold. X-ray showed a supracondylar fracture.

When the reporter saw this patient his hand and forearm were cold and mottled. There was no pulsation in the radial artery. There was a marked swelling extending from the elbow to the tips of the fingers.

An incision was made four inches in length, longitudinally on the outer aspect of the lower part of the arm, elbow and forearm, the brachial artery being easily identified. One and one-half inches above the joint an organized thrombus was found which was about 1.5 cm. in length. One could readily see the pulsation ceased at the thrombus. It was necessary to reduce the dislocation to relieve the tension on the artery. When this was accomplished a catgut ligature was placed around the artery, but not tied, but held firmly enough to stop the circulation. An incision was then made in the artery just below the blood clot, from which there was no bleeding. All efforts to remove the clot failed. Another incision was made about a half inch above the clot, from which there was active bleeding, and which could be controlled by the ligature. With the aid of a large, curved, round needle which was passed behind the artery, the clot was dislodged from its site to the opening above. An effort was made to remove it through the upper opening but without success. With the needle, which was passed behind the artery, he was able to milk it free, and it appeared at the lower opening, and from this point he was able to remove it. The circulation was immediately resumed below the clot. A small, hot sponge was applied over the incisions on the artery for a few minutes which checked the bleeding noticeably and after a few minutes more the bleeding had stopped. A few strands of silkworm gut were placed in the wound superficially, the arm put in abduction and constant heat applied. That night the pulse rose to 150 and the temperature to 104° F. After that he made an uneventful recovery. The radial pulse was watched for very carefully, and it appeared five days post-operative. The color of the forearm and arm was much improved the following day. At the end of the third day the color was almost normal, but the swelling persisted till he was taken home ten days post-operative. He was not examined neurologically and his first knowledge of nerve involvement came yesterday.

## CONGENITAL CYSTIC KIDNEY

DR. HOWARD LILIENTHAL considered this case report very important, not because the pulse came back, but because the bleeding stopped after making such large openings in the artery. He could understand that if the bleeding could stop spontaneously it might be a disadvantage to try to close by suture. If the bleeding ceased and there was no infection, there should be no secondary hemorrhage. He understood that the incisions were in the long axis of the vessel.

DR. HAROLD NEUHOF thought that if the pulse return had been delayed for several days, as he had understood, the return could be accounted for by canalization through the thrombus. In his experience the only reliable evidence of restitution of circulation through an artery was the immediate return of pulsation in the vessel distal to the site of operation. This held true of some lesions of the brachial and popliteal arteries he had operated upon.

DOCTOR CONNORS, in closing, said that immediately after the removal of the clot, in as far as the artery was visible, the circulation had returned in the brachial artery. The next day the color of the arm was normal. The radial pulse returned on the morning of the fifth day, but all the circulation he could vouch for was what he saw. The fact that the artery did not bleed was not surprising, for he had operated upon a case in France, removing a piece of high explosive from the carotid, in which there was no bleeding. And in the cases of arteriovenous aneurisms which he had done, it was surprising how easily the bleeding was controlled after suturing the artery. The incisions in the artery were longitudinal.

## CONGENITAL CYSTIC KIDNEY

DR. WILLY MEYER presented two patients in whom he had done Rovsing's operation for congenital cystic kidney.

The first case, a female, thirty-four years old, married, two children, had a bilateral affection. She had suffered from frequent urination, pain in abdomen and back, for several years. In both lumbar regions a well-palpable tumor was found with an irregular surface, which moved up and down with respiration, the right being larger than the left. Air inflation of the colon showed the tumors situated retroperitoneally. As the condition was bilateral, the diagnosis of congenital cystic kidney could be made with certainty.

The first operation, on the right side, was done on October 15, 1918, at the patient's request, under general anæsthesia, at the Post-Graduate Hospital. The usual posterior hockey-stick incision was made. After division of the deep fascia the kidney appeared, and could be brought in front of the wound. It showed the usual beautiful picture seen in cystic kidneys, the cysts shining in all colors of the rainbow. All the cysts that could be reached were opened and some of the sacs excised. The organ was quickly reduced to less than half its previous size and replaced; the wound was sutured in layers, a split drainage being introduced at either end. Primary union followed.

On March 6, 1919, the same operation was done on the left side, again under general anæsthesia, at the request of the patient, this time at the Lenox Hill Hospital. The same picture was found and the same technic followed. Primary union again took place.

To-day the patient is greatly improved, has gained in weight and is able to attend to her daily work.

The second case also was a female, forty-three years old, mother of several children. She had been sent to the Lenox Hill Hospital with the diagnosis of intraperitoneal, probably colonic tumor. However, the history revealed that she had been suffering from pain in both sub-costal and lumbar regions, right more than left, for the last eight years. On the right side there was a large, freely movable tumor, low, as a movable kidney, with distinct ballottement on bimanual palpation; its surface was irregular. On the left side the tumor was smaller, but well defined. Congenital cystic kidney was diagnosed, and the retroperitoneal position again proved by blowing up the colon with air. Operation was done on April 26, 1920, under regional and local anæsthesia, the eleventh and twelfth dorsal and first and second lumbar nerves being injected; during the operation direct injection of the twelfth intercostal and ilio-hypogastric nerve was added. The operation proved quite feasible and the patient only complained of some annoyance when the tumor was lifted out of its bed. The size of the kidney could again be reduced to less than half, so that reduction was easy. Closure by layer sutures. Primary union followed.

To-day the patient still has some pain in the right side and complains of sleepiness. So far she could not make up her mind to have an operation performed on the other side. She has gained decidedly less in weight than the first patient.

The speaker had had no chance to test the function of the kidneys, as he succeeded only a few days ago in locating the two patients.

He also referred to a third case on whom he operated a few years ago on one side, the second operation being performed at the Mayo Clinic. The patient, a young man, is perfectly well apparently.

Rovsing's operation certainly means a great step forward in the treatment of this otherwise fatal condition. It will be of interest to watch these patients to see how long the improvement will last. Eventually, a second operation might be performed, should the cysts that could not be reached at the first, increase in size and compress the renal parenchyma.

DR. EDWIN BEER stated that it would be very valuable if such operations on congenital cystic kidneys led to the result described by Doctor Meyer. It was highly doubtful whether, judging from the pathology of the disease, the incision or excision of multiple cysts would be followed by relief of the kidney disturbance and improvement in function. Before one can really definitely decide upon the value of the Rovsing operation, it would be necessary to study a great many such cases with careful pre-operative and post-operative functional kidney tests; otherwise, one will have no idea as to whether improvement follows the above operation. These cases of congenital



## TUBERCULOSIS OF SHEATHS OF FLEXOR TENDONS

cystic kidney often live to be fifty years old without any symptoms, and as far as he could see from Doctor Meyer's presentation, there was no cogent reason for believing that either one of his cases had been improved by the operation. Until Doctor Meyer was ready to present careful pre-operative and post-operative functional studies, Doctor Beer believed the improvement, which Doctor Meyer emphasized in these two cases, would have to remain sub-judice.

DOCTOR MEYER replied that, as mentioned before, he had not been able to get hold of the patient in time to have these tests made. But as regarded the first patient one could see that she is in good general condition, able to attend to her housework. The second one, who only had one side operated upon, is not so well. This operation offers the only way of keeping these patients alive.

## TUBERCULOSIS OF SHEATHS OF FLEXOR TENDONS OF FOREARM AND HAND—RADICAL EXTIRPATION

DOCTOR MEYER stated that sometime previously he had presented before this Society two male patients in whom he had extirpated radically the sheaths of the extensor tendons of the fingers and forearm. Both had regained full function of their hand and now showed a patient with the same trouble on the flexor side.

A woman, thirty years of age, who had noticed increasing weakness and uselessness of the hand for two years before she came under his care. The typical picture of this condition was present: A distinctly fluctuating sac on the volar side, divided by the annular ligament in such a way as to produce the well-known hour-glass shape. On pressing the swelling above the ligament, one could distinctly feel the soft crepitation of rice-corpuscles present. Radical operation was decided on and done on April 29, 1920. Sehrt's metal tourniquet was applied to the upper third of the arm, not in the middle, over a compress of gauze, in order that the musculospiral nerve might suffer as little as possible. A longitudinal incision was made over the tumor, the annular ligament divided, the median nerve exposed and pulled aside. The superficial vascular arch was doubly clamped, divided and ligated. The presenting bursa was then treated as a tumor to be excised, loosening it bluntly all around into the depth of the palm of the hand. It was then excised, the rice corpuscles removed, great care being taken to extirpate the entire mass in one piece, advancing from tendon to tendon and carefully preserving the synovial covering of the tendon itself. At the completion of the extirpation, the bare tendons crossed the wound in their anatomical relation. The wound was flooded with a five per cent. iodoform ether solution, in which the speaker said he had the greatest confidence in tuberculous cases. The tourniquet was opened, the vessels secured and the skin-wound closed with interrupted silkworm gut sutures; this was then covered with sterile rubber tissue to provide for the moist blood-clot formation; a dorsal splint was put over the dressing, keeping the



fingers in full extension. The first dressing was allowed to remain in place for fifteen days, with the patient out of bed almost the entire time. The wound was found healed. The patient was then put under a careful physical treatment in order to improve the function of the various fingers. She now shows a perfectly useful hand, enabling her to do all her housework. She can form an almost complete fist, the motion still somewhat lacking is that of flexion of the extended fingers.

These cases prove that the radical extirpation of the tuberculously inflamed sheaths of the extensor, as well as flexor tendons, is feasible, and that careful after-treatment can restore the function of the fingers and hand.

The only other method of treatment that could come into consideration would be the X-rays which have been tested to advantage of late in tuberculosis of various organs. However, the final result of the treatment being doubtful, and a number of sittings being required, the speaker, at the present time, would prefer the operative procedure.

#### APPENDICOSTOMY FOR CHRONIC ULCERATIVE COLITIS

DOCTOR MEYER presented the case of a patient, female, twenty-one years old, who showed in April, 1918, all the signs of ulcerative membranous colitis, neither of specific nor tuberculous origin. The trouble had existed for four years. Rectoscopy showed ulceration near the sigmoid.

An appendicostomy was performed on May 6, 1918, through an intermuscular incision, stitching the base of a rather long appendix to the middle of the peritoneal incision, and allowing the organ itself to pass through the layers of the abdominal wall in a slightly oblique direction, the tip of the appendix projecting about three-quarters inch. The meso-appendix was carefully preserved; layer suture finished the operation. With the abdominal wound dressing in place, the projecting appendix tip was then amputated about one-half inch above the abdominal wound and its patency tested. Its lumen was found to be permeable, although at two places a slight stricture had to be overcome; the base was then gently ligated with a catgut thread and a dressing applied. After forty-eight hours this ligature was removed, the distal end being found necrotic. A few days later the slough came off, and regular irrigation of the large intestine was started. Of all salts, that of nitrate of silver, used in gradually increasing doses, appeared to have the best effect. During all these years the fistula, which had formed in the shape of a lip-fistula, was so small that it was hardly discernible, but the patient was able to introduce a soft-rubber catheter, through which the irrigations were kept up. There has never been any secretion; dressings were not needed.

The trouble as such was cured and the patient advised not to have the opening closed, but rather keep it as long as possible as a safety valve.

Recently, after a somewhat long intermission, it was found difficult to reintroduce the soft rubber catheter and it took quite some careful manœuvring to widen the canal without perforation. The patient reports

## SCHEDÉ'S OPERATION FOR EMPYEMA WITH BRONCHIAL FISTULA

that off and on she feels a stiffening of the organ, which has also been observed by the speaker in this case, evidently due to the presence of the two strictures, in consequence of which the lubricant with mucus and fecal matter which eventually enters the canal could not be readily discharged. It may become advisable now to excise the appendix. Meanwhile the patient has gone through two confinements, without any trouble from the scar or interfering with the efficiency of the appendicostomy.

Comparing the effect of cecostomy and appendicostomy as regards the patient's comfort, the latter procedure is decidedly preferable, as it enables the patient to carry out the irrigation of the large intestine from above, without having all the discomforts of a large intestinal fistula.

## SCHEDÉ'S OPERATION FOR EMPYEMA WITH BRONCHIAL FISTULA

The case presented by Doctor Meyer was a young man, twenty-six years of age, who had been in the Medical Division of the Lenox Hill Hospital for acute pneumonia, developing an empyema. After the diagnosis of the latter he was transferred to the Surgical Division. There was a family history of tuberculosis.

On March 3, 1919, a fairly large piece of the seventh rib was resected in the axillary line. The pleural cavity was filled with fibrinous coagulations; after thorough evacuation, the lung was found totally contracted near the spine, with a large bronchial fistula visible. In spite of this, Dakin's treatment was carried out and well borne by the patient, although at times he coughed up the solution. After a few weeks his condition was good; the fever had disappeared; but the usual blowing of the James' bottles naturally did not bring any further improvement. One could hear the air blown out of the fistula. To the speaker's mind only two procedures could now come into consideration—either extra-pleural thoracoplasty (multiple resection of ribs) in order to collapse the cavity, with a rather doubtful prognosis as to ultimately closing of it. Besides such a procedure probably would have caused prolonged suppuration which, in view of the tuberculous history, was considered undesirable. The other alternative was the typical Schede operation which would bring the skin to the surface of the lung. The latter operation was decided on and carried out on May 5, under regional and local anæsthesia.

After raising the flap and a long intercostal incision having been made allowing the introduction of the hand in order to find the outlines of the cavity, the tenth to fourth ribs were resected posteriorly and the intercostal bundle of arteries ligated en masse with the other tissues above the bed of the fourth rib, representing the upper border of the cavity, was incised and followed anteriorly; at the latter place the advice of Bier was then followed and the entire chest-wall, ribs and soft parts sewed through under the guidance of the surgeon's eyes with fingers inside, which greatly expedited the operation. In this way the lung was entirely exposed and care taken to remove projecting ribs in order to have the skin fall in easily. The bronchial fistula was clearly seen, but it could not be dissected and eventually ligated, on account of

the patient's poor general condition. In using the scapula to cover the defect, it was placed in such a way that the bronchial fistula remained uncovered. The skin flap was stitched in place with a few interrupted sutures.

After the first stormy days the patient made a good recovery. He was instructed to use the arm as much as possible, so that good function might result. The wound healed kindly, but a fistula on the inner side of the scapula remained. The X-ray showed a long stretched-out cavity, of hour-glass shape, with a very small intermediate canal. The patient being a chauffeur and in service, a radical operation was not considered, but the wound arranged in such a way that the space behind the scapula could be left for gradual cicatrization. Still, the bronchial fistula continued, producing an abscess in front within the axillary incision. At this time the use of the Kromeyer lamp was started with the help of an especially constructed Quartz sound. This allowed the rays to enter the real depth, and under several weeks' careful treatment with additional antituberculous therapy, the wounds closed completely.

It is principally to show the salubrious effect of these rays also in complicated cases with deep-seated fistula that the speaker presents this patient. After a recent severe coughing spell the wound reopened and discharged for a few days, but local treatment promptly effected its closure. To-day the patient is in perfect condition and has the full use of his arm.

DR. HOWARD LILIENTHAL thought that if he had been treating this patient he would have tried to disinfect the cavity with Dakin's solution by the Carrel method and later on would have allowed the wound to close. He believed the bronchial fistula would have closed spontaneously in these circumstances. He doubted that the Kromeyer lamp had caused it to close. He did know, however, that among his cases of lung resection only one bronchial fistula remained open; even that closed temporarily with pneumothorax and was only kept open by the patient after several refillings of the cavity. It was a case of subtotal pneumectomy. All the others had remained closed and that was a more severe test than empyema. One of his cases showed now, four years after lobectomy of the upper lobe, a large pneumothorax, perfectly aseptic, and in that case the patient went through typhoid fever without accident. The patient is perfectly well. Collapse operations of some sort might be necessary in cases of tuberculous empyema.

DR. A. V. MOSCHCOWITZ said that it always gave him pleasure to see a cured case of chronic empyema. In the present instance, however, it did not appear to him that so extensive an operation as the Schede operation is, was indicated. If he had to treat this case he would have persisted in the use of Dakin's solution until the cavity became sterile, and this he would have done in spite of the presence of pulmonary fistula. When the cavity had become sterile, as proven by repeated cultural examinations, he would have allowed the outer opening to close. Doctor Moschcowitz said that he has had good results in so many cases that he now looks upon this method as

#### RESECTION OF RECTUM FOR CARCINOMA—COMBINED OPERATION

the standard method of treatment. A very important point in this case that Doctor Meyer mentioned was the existence of a strong tuberculous element, and it is well known that these cases are unusually difficult to cure.

DOCTOR MEYER, in closing, said he had called this a subacute empyema because the patient had had an empyema operation in March and the Schede operation in May, so the condition had become subacute. As to the fistula spoken of by Doctor Lilienthal, there was a large one, but it was in the depth of the empyemal cavity which would have remained a cavity. So it was clearly indicated that inasmuch as the lung would not come to the chest wall, to bring the chest wall to the lung. He considered this patient a case in which there was an empyema with a tuberculous tendency. Looking back after three years he still believed that a radical operation had been clearly indicated. There was one thing which he had seen in a number of these extensive chest-wall operations. This patient, too, remained in a seemingly profound collapse in spite of intravenous and subcutaneous stimulation. He was then placed under oxygen plus pressure for almost twenty hours, which steadied the mediastinum and gave the heart time to adapt itself to the new anatomical conditions.

#### RESECTION OF RECTUM FOR CARCINOMA—COMBINED OPERATION

DOCTOR MEYER presented a woman thirty-four years of age, married and the mother of several children, who had been operated upon six months before for hemorrhoids by another surgeon. She continued to lose weight and symptoms pointed to the presence of a tumor, which was found by the rectoscope, its lower border being about three inches above the anus.

On May 5, 1921, Doctor Meyer performed a combined operation under general anæsthesia. Left rectus incision; liver not involved; the tumor was palpable low in Douglas' pouch, its seat being at the fornix of the vagina, very tightly adherent. Double ligation and division of inferior mesenteric artery, just below the exit of the left colonic artery. High Trendelenburg posture; incision of peritoneum at outer border of descending colon and sigmoid down into Douglas' pouch; exposure of tumor difficult on account of the depth and the adhesions of the tumor; sacral cavity entered and rectum loosened from above, bluntly, as far as possible, separating it from the cervix and vagina. Introduction of a sterile tampon on either side of the rectum; layer closure of abdominal wound; transfer on apparatus which allowed knee-elbow posture. Typical Kraske operation, resecting the lower end of the sacrum with the coccyx. After division of the pelvic fascia, the gauze tampons on either side are easily reached, greatly facilitating the further work. After ligation of middle and inferior hemorrhoidal arteries, the sigmoid can be pulled down a considerable distance. Closure of Douglas' pouch, attaching it by suture to the sigmoid; one cigarette drain to peritoneal cavity. After careful tamponade of the entire wound, the sigmoid is doubly clamped and divided with the cautery two inches above the tumor; temporary closure of proximal stump with a continuous mattress suture



of silk and additional inversion with interrupted mattress sutures, the threads of which were left long; double clamping and division of rectum one and a half inches above anus, which means removal of the tumor-bearing intestinal loop; distal end cauterized. After lysol cleansing, the rectal stump is everted and the mucosa excised; after re-inversion, the sigmoid is pulled through the anus, which had been slightly stretched, projecting about two inches. The closed stump is then fastened to the skin with a few silkworm-gut sutures. The wound closed with drainage; a permanent catheter was placed in the bladder. Patient stood the operation well. After normal pulse and temperature for two days, the latter began to rise. Sixty hours later, first change of dressing with the intention of amputating the projecting portion of the intestine. On lifting patient to the operating table a discharge with audible gas report took place. It was found that the projecting portion was flabby and gangrenous, probably in consequence of the constriction by the but gently stretched anal ring. The immediate consequence of this gangrene of the projecting portion of the gut was a continuation of the same on to the pelvic fascia, which greatly interfered with the after-treatment.

The most interesting point, which particularly prompted the speaker to present the case, was the paresis of the bladder, which long refused to yield to all treatment. It was no easy matter to convince the patient that spontaneous micturition would surely return—a hope which could be rightly entertained, as the phenomenon had been seen repeatedly after resection of the rectum for carcinoma, the function, however, always returning. In this case it took fourteen weeks, when at last spontaneous micturition reappeared. After a few weeks the patient was sent to the country where she spent the greater part of last winter. To-day she has gained over sixty pounds in weight and has full control of her stool. With the examining finger in the rectum, a distinct voluntary contraction of the sphincteric ring can be noticed. A small sinus still leads into the sacral cavity, which, however, gives all promise of closing in a very short time.

In former operations the speaker had always sacrificed the entire lower portion of the rectum inclusive of the sphincter—with one exception which also had given a favorable result with regard to control—the proximal stump being fixed, according to its length, close to the sacrum (sacral anus) or as low down to its normal position as possible, in order to enable the patient to have the normal procedure in defecation; of course reliable control could not be rendered.

After this experience the speaker inclines to try oftener the preservation of the lowest portion of the rectum; the great advantages to the patient are apparent. He is also inclined to do the combined operation in one sitting and feels that he cannot place too much emphasis on the excellent result of primary ligation of the inferior mesenteric artery from above with regard to mobilizing the sigmoid flexure.

The pathologic report in this case was: Adenocarcinoma. Inasmuch as great care was taken to remove all visible glands from above, the hope exists



## RESECTION OF RECTUM FOR CARCINOMA—COMBINED OPERATION

that the patient may enjoy the result of the operation for some time to come. A further report will be given after the lapse of a few years.

DR. WILLIAM C. LUSK said that yesterday he had examined a patient (male), now thirty-nine years of age, whose rectum he had resected for adenocarcinoma nearly twelve years ago. There was no recurrence. The inferior hemorrhoidal nerves had been preserved intact and the sphincters had always functionated normally, and there had not been the slightest stricture resulting from the operation. The patient had been shown before this society in October, 1910 (*ANNALS OF SURGERY*, 1910, pp. 836 and 855). The tumor had been situated in the anterior rectal wall, its lower margin lying from one and a half to two inches above the upper margin of the internal sphincter. The operation was done by the combined routes in two stages, the first stage almost entirely under spinal anæsthesia, and the second stage on the following day under ether narcosis, at which latter the resection was performed, the anastomosis having been effected between the descending sigmoid and the distal segment, section having been made an inch below the tumor, by circular (interrupted) suture done within the posterior wound above the sphincters. The value of two principles applied in this resection would seem to have been substantiated by the result, namely, first, that the upper division of the bowel be made through the lower sigmoid so that the proximal segment in the anastomosis should be completely covered with peritoneum (there was a large marginal artery in this patient at the site of section of the sigmoid), and, second, that the mucous edges of the suture line be brought together in very accurate alignment. In this case the latter object was accomplished, by inserting holding sutures through the mucous edges (including the serous edge of the proximal segment) at intervals, catching up opposite points of the bowel ends to be united, so that when any two adjoining holding sutures were pulled apart, they would hold the mucous edges in even apposition, while deeply placed stitches, including about half an inch of either margin, were passed and tied. A very helpful practice in performing this anastomosis, learned from Kraske, was the placing of holding loops at intervals along the margin of the distal segment of gut, as the latter became severed by interrupted cuttings below the tumor, for the subsequent control of this edge in suturing.

In comparing circular suture of the bowel ends done through the posterior wound above the sphincters, with suture of the ends after their invagination through the anal canal, he regarded that the former method had all the advantages. With the former technic it required the descent of from five and a half to six inches of the freed sigmoid extremity into the pelvic cavity below the level of the left common iliac artery to effect the anastomosis above the sphincters without tension, while with the latter technic the freed sigmoid extremity would have to be capable of a descent sufficient to enable it to pass through, and protrude from, the anal canal, an attainment anatomically often impossible, and one attended with increased liability of the occurrence of sloughing. As regarded the distal segment, when circular suture above the

## NEW YORK SURGICAL SOCIETY

sphincters was done, this piece of bowel, remaining fixed to the soft parts, retained its nourishment and maintained the suture line in relation to peripheral tissues with which supporting adhesions might form, while with the invagination technic, a sufficient length of rectal wall above the internal sphincter was needed for the formation of a cuff to invert through the anal canal, which when reduced above the sphincters after the anastomosis had been made, having no mural support, would, together with the seat of the anastomosis, lie collapsed in a way to encourage stricture formation. The question of the viability of the rectal cuff, dissected from its peripheral vascular connections and with its blood supply from the superior and middle hemorrhoidal arteries cut off, should also be taken into consideration.

## MASSIVE COLLAPSE OF THE LUNG

DR. FORDYCE B. ST. JOHN read a paper with the above title.



FIG. 1.—Securing a large skin graft. (Dorrance.)



## CORRESPONDENCE

### SECURING LARGE SKIN GRAFTS

EDITOR ANNALS OF SURGERY:

SIR:

IN the ANNALS OF SURGERY of March, 1920, I gave the method I was employing in placing a skin graft in the oral cavity, and made the statement that I never failed to obtain a graft. Since the publication of this article, I have received numerous requests as to the method of obtaining these large grafts. A research of the literature on the technic of skin grafting made several years ago proved disappointing in many respects. The type of cutting instrument used seemed to be the most important factor in the minds of most authors. As a matter of fact, any razor or amputating knife will answer our purpose, if the following rules are observed.

1. Use the blocks suggested by Halsted to obtain longitudinal tension and the broad, flat surface.
2. Have the assistant place his hands under the arm or thigh from which the graft is to be taken, and by grasping the skin firmly, obtain a strong lateral or transverse tension.
3. Use salt solution or vaseline to anoint the area from which the graft is to be taken.
4. After the graft is started, do not pause, but keep up a continuous lateral or to-and-fro motion until the desired length is obtained.

The most important factor, to my mind, is the immobility obtained of the lateral fixation of the skin by the assistant's hands.

The method is not original, but I am unable to locate the article in which it was first suggested. The cut shows the method better than words could.

GEORGE M. DORRANCE, M.D.,  
*Philadelphia, Pa.*

### PRESSURE AS A FACTOR IN SKIN GRAFTING

EDITOR ANNALS OF SURGERY:

SIR:

Many different methods of applying the various types of skin grafts have been used with varying success. Some have urged the importance of a bacteria-free surface before placing grafts and attribute the success of the operation to careful field preparation. Others graft unhealed areas without giving much thought to the state of infection. It is generally the opinion that the surface to be grafted should be reasonably free from active infection, but not necessarily rendered sterile as shown by culture. In this operation it is well to remember that all bacteria on skin and wound surfaces are not virulent and may not inhibit the growth of grafts.



## CORRESPONDENCE

Regardless of the condition of the graft and the grafted area, the former must be held in place in such a way that the granulation tissue may grow into the grafts. To accomplish this the contact must be snug. Grafts that are floated loose from the surface by pus, blood or serum have no chance to receive a blood supply from the healing area and become viable.

It has been definitely shown that adhesive strapping is of value in the stimulation of epithelial growth in ulcerated areas. What the factor is in its use is not quite clear. It may act only as a bridge along which the epithelium creeps, or, as pointed out by Dr. E. D. Twyman,<sup>1</sup> may by its pressure restrain the growth of excessive granulations and not interfere with epithelial progress. He states that "epithelium proliferates readily when subject to a degree of pressure which restrains the growth of granulation tissue." If this is true, it would apply in the case of skin grafting. Adhesive strapping fixes the graft firmly to the grafted surface, holds it from slipping and furnishes an opportunity for capillary attachment or "taking." In addition it prevents the upgrowth of excessive granulations which is a hindrance to healing both to the new grafts and the edges of the ulcerated or denuded area.

For several years I have fixed skin grafts in place on the grafted surface by simple strapping with strips of zinc oxide adhesive as used by Vosburgh.<sup>2</sup> After all grafts are in place strips of adhesive, two or three cm. wide, are flamed and drawn snugly across the area. Pressure enough is used to firmly hold the grafts to the surface, thus squeezing out any blood or serum that may have collected beneath. The pressure should not be great enough to blanch the surrounding skin and disturb circulation. The straps are narrow enough to afford drainage of the areas between them, and are placed closely enough together so that all parts of the graft are held firmly down.

At the end of ten days the adhesive is removed without disturbing the grafts if they have grown in place. If they have not become attached in that time, they are a failure. During the ten days, if the discharge from the wound is too profuse, the dressings may be changed down to the adhesive as frequently as necessary. There is no opportunity for the granulations to become excessive and attach themselves to the adhesive. It is unlike gauze and other meshed material in that it prevents granulations from growing upward through the dressing and thus hindering epithelialization. In addition there is no trauma when the adhesive is removed as there may be with the gauze dressing. The adhesive is always free at the expiration of ten days.

The adhesive strapping method is applicable to any type of graft. If the graft is large it is wise to snip openings in it to avoid the collection of pus or serum beneath.

It seems quite definite that pressure serves a double purpose in skin grafting; it holds the grafts firmly in place against the unhealed area and stimulates



[ FIG. 1.—Skin grafts strapped down with strips of zinc oxide adhesive.

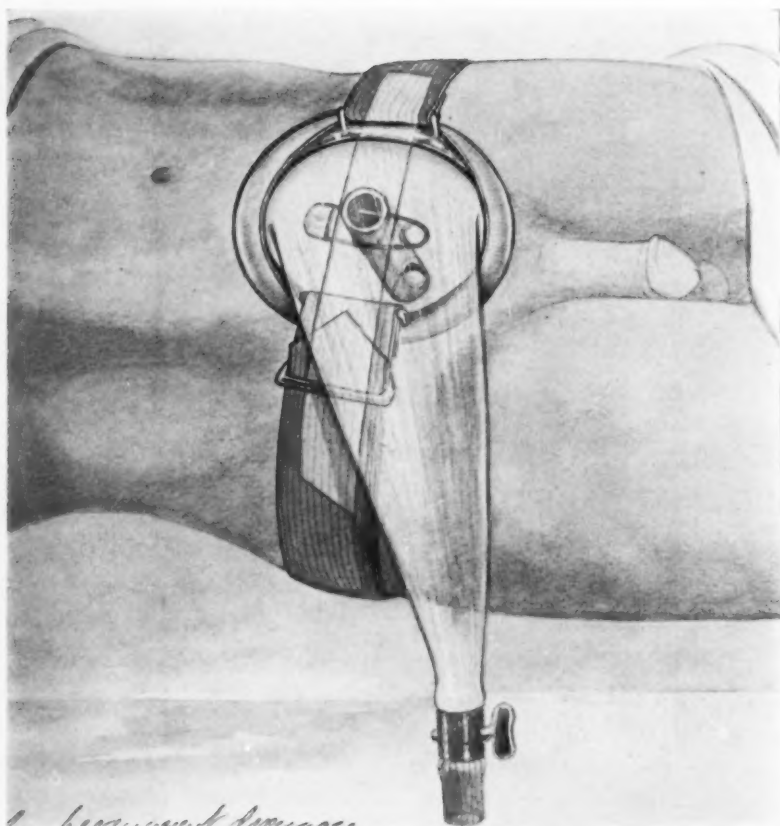


FIG. 1.—Apparatus for permanent drainage in bladder cancer.

## CORRESPONDENCE

rapid epithelialization by preventing excessive granulations. If adhesive strapping promotes rapid growth of epithelium at the edge of an ulcer, it is quite reasonable to believe that grafts may be stimulated to more rapid growth in the same way. The method is simple and seldom fails when autografts are used.

THOMAS G. ORR, M.D.,  
*Kansas City, Mo.*

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- <sup>1</sup> Twyman, E. D.: *Jour. Mo. State Med. Asso.*, June, 1922, vol. xix, p. 257.  
<sup>2</sup> Vosburgh, A. S.: *ANNALS OF SURGERY*, 1912, vol. lv, p. 891.

## DRAINAGE IN BLADDER CANCER

EDITOR *ANNALS OF SURGERY*:

SIR:

The difficulties of permanent drainage of the bladder in inoperable or recurrent carcinomata of the bladder and prostate gland is evident to all who have had charge of these unfortunate patients. If the drainage tube is small, it is likely to become plugged with blood clots, while on the other hand if it is large it is unwieldy and produces more or less discomfort.

During the past two years we have modified the method of dealing with these patients and the results have been quite satisfactory. Our plan is as follows: The bladder wall is sutured to the abdominal wall and a tube  $\frac{1}{8}$  to  $\frac{1}{2}$  inch in diameter is inserted. Suture of the bladder to the abdominal wall is not necessary but facilitates, subsequently, the introduction of the tube. The incision is closed in the usual manner and the tube is cut off so as to project about  $\frac{1}{4}$  inch above the skin. A very large safety pin is then passed through the outer part of the tube. A strip of sterile adhesive plaster with a hole in it is carried over the end of the tube and safety pin in such a manner as to hold the tube in place. Sterile vaseline or zinc oxide ointment is smeared around the area of the incision. Then a large colostomy ring with a rubber sleeve over it ( see Fig. 1) is placed so that the ring does not press on the incision. The strap is adjusted around the back and tightened until comfortable.

The urine is carried through a tube into a bottle by the bedside.

Moving this tube or traction on it does not cause any discomfort because it is attached to the belt rather than to the tube in the bladder. All of the tubes are large and allow the passage of clots.

The device may be removed from time to time as indicated (2 to 7 days) and the tube in the bladder removed, cleaned and boiled. Dakin's solution, argyrol or other medicament may be injected, as indicated, through the outer tube or through a catheter passed into the bladder.

## CORRESPONDENCE

If desired radium at times, may be applied through the incision as the opening is kept rather large.

Surprisingly little trouble is experienced in the management of malignant growths of the bladder or prostate by the plan above outlined; in fact, a nurse or orderly or a member of the patient's family can make the changes when necessary.

It is not suitable for patients who are very thin and whose symphysis projects so as to prevent a smooth seating for the ring or large colostomy device.

The tube may be disconnected when the patient is up and the cock drained from time to time as the urine accumulates.

The patient is kept dry when he is on his back, propped up in bed, is in a wheel chair or is walking around, but it is likely to leak when he lies on his side.

EDGAR G. BALLENGER, M.D.  
*Atlanta, Ga.*

## GONOCOCCUS IN ARM ABSCESS

EDITOR ANNALS OF SURGERY:

SIR:

The following case is reported because the appearance of the gonococcus in an ordinary abscess or sinus has been very rarely, if ever, recorded in the literature. A white woman, age twenty-two years, married seventeen months, presented herself on February 24, 1921, with a sore on her right arm, which "will not heal."

On February 1, 1921, a pimple appeared on the right upper arm. By the day following, the arm had become swollen, quite red, exquisitely tender and painful. The woman then applied to a certain genito-urinary specialist, who stuck a needle into her arm and then opened the pimple with a knife. This doctor visited the woman twice at her home and dressed the wound. The inflammation, however, spread; the pain was unrelieved, the wound continued to discharge pus and the surrounding tissues burned and itched. The woman was first seen by me February 24, 1921. She was robust and well nourished. The temperature was normal. With the exception of the lesion described below, the physical examination was absolutely unproductive. The sore was on a line with the posterior border of the deltoid muscle and some 2 cm. below its insertion. It was 1.5 cm. in diameter and 0.5 cm. in depth. The edges were fairly regular, slightly undermined, and had a punched-out appearance. The base was covered with a purulent exudate which, on removal, revealed a healthy red color, as of muscular tissue somewhat thrown up into papular nodules. At its upper and posterior margin was seen a small circular opening about the size of the shaft of a large pin. Pus was squeezed from this orifice and a platinum wire was introduced into a sinus



## CORRESPONDENCE

to the depth of 1 cm., without causing pain. The exudate was creamy white, odorless, and of small amount. The abscessed area was surrounded by a red halo. The blush measured 0.5 cm. across. The tissues beyond looked and felt normal. The epitrochlear, axillary and cervical lymph-nodes were not palpable. When the two arms were compared, no difference in size was apparent. Stained smears showed polymorphonuclear pus cells, a few mononuclear cells and gram-negative intra- and extracellular diplococci. The lesion was washed with alcohol and a dry dressing applied. On February 25, 1921, a new series of smears were made with the same results. On this date some of the pus was planted on plain agar and a liberal portion smeared on blood serum agar. One set of cultures was cotton stoppered, the other oxygen reduced. No growth resulted. On February 26, 1921, smears and cultures were again made and forwarded to Dr. Percy D. Meader, bacteriologist, The Johns Hopkins University, School of Hygiene and Public Health, whose report is as follows:

"Microscopical examination of this discharge disclosed almost a pure culture of a gram-negative bean-shaped diplococcus, but was not intracellular. Although the discharge had been away from the patient for some time an attempt was made to grow the organism on suitable media, but a diphtheroid which was the only other organism present in the smear preparations was the only organism cultivated. This rather confirms the microscopical examination since the gonococcus fails to grow unless planted almost immediately after the discharge is obtained from the patient.

"A test for the presence of gonococcus protein in the discharge was made by the method recently published by Dr. G. H. Robinson and myself. This test was strongly positive. In a series of nearly 1000 examinations we have yet to find the precipitin test giving a false reaction.

"The result of these examinations indicates conclusively that the sample of discharge given to me contained the gonococcus.

On February 28, 1921, smears and cultures gave the same results as before. The precipitin test was again positive. On March 1, 1921, smears were submitted to Dr. Howard J. Maldeis, visiting pathologist, University Hospital, who confirmed the previous findings. As the sinus had up till now proved refractory, it was irrigated with protargol, and nitrate of silver applied. On March 3, 1921, the patient was seen by Dr. Alexius McGlannan, Professor of Surgery, in the University of Maryland. Cultures and smears were again made and a blood culture taken. Smears on this date showed gram-negative intra- and extracellular diplococci, apparently swollen and associated in chains of four to six organisms. The wound was washed off with ether, burnt with silver nitrate, and dry gauze applied. The sinus had disappeared and the exudate was very scant. The cultures made this date again failed to yield a growth, but the blood culture showed a streptococcus hæmolyticus. March 6, 1921, the wound had entirely healed, leaving behind

## CORRESPONDENCE

as a relic an indurated scar about one cm. thick. A blood culture made this date was negative.

This case is very interesting in that the gonococcus was recovered from an abscess in an arm of a patient who previous to her visit to a surgeon for treatment of a furuncle, had never been exposed directly or indirectly to the Neisser infection, and who did not have, nor had ever had, gonorrhœa. It demonstrates conclusively the gonococcus that may cause an abscess of the soft tissues. In this instance the infection was undoubtedly inaugurated by the knife of the specialist in venereal diseases who first treated the patient. So far as I am aware, the case is unique in the medical annals as a most thorough search of the literature has failed to reveal anything like it.

WILLIAM J. FULTON, M.D.,  
*Baltimore, Md.*

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### **ANNALS of SURGERY**

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## INDEX TO VOLUME LXXVI

### A

- Abscess of Arm Due to Gonococcus, 802;  
Hepatic, Evacuating Via Bronchus, 591.  
Actinomycosis, 277.  
ADAMS, DONALD S.: End Results of Operations for Carcinoma of the Breast, 346.  
Adenoma of Colon at Hepatic Flexure, 674.  
Adrenal Gland, Extirpation of, for Epilepsy, 176.  
ALEXANDER, EMORY G.: Prolapse of the Rectum in Children, 496.  
ALLEN, DUFF S.: Reconstruction of the Oesophagus with Fascia Lata Transplants, 157.  
Aneurism, Cirroid, of the Scalp, 524; Gluteal, Ligation of the Internal Iliac for, 520.  
Ankylosis of Jaw, Use of Dilator in Treatment of, 647.  
Appendicostomy for Chronic Colitis, 792.  
Appendix Vermiformis, Intussusception of, 669.  
Artery, Brachial, Embolism of the, 788; Femoral, Gunshot Wounds of, 651.  
Arthritis Deformans, Intestinal Foci of Infection in, Surgical Relief of, 515; Arthritis of Knee-joint, Chronic, 126.  
Arthroplasty of the Elbow, 615.  
Arthrotomy for Chronic Arthritis of Knee, 782.  
ASHHURST, A. P. C.: Technic of Disarticulation of the Hip-joint, 115; Congenital Absence of Patella, 280.  
AUCHINCLOSS, HUGH: Intussusception of Appendix, 670.

### B

- Back-fire, Injury of the Limbs Due to, 83.  
Bacteria in the Blood Stream, The Surgical Significance of, 421.  
BALFOUR, DONALD C.: Factors Influencing the Life Expectancy of Patients Operated on for Gastric Ulcer, 405.  
BALLENGER, EDGAR G.: Drainage in Bladder Cancer, 801.  
BEER, EDWIN: Cysts of the Kidney, 658; Congenital Cystic Kidney, 790.

- BELL, WILLIAM LISLE: Treatment of Fractured Clavicles, 595.  
BERNHARD, ADOLPH: Estimation of the Bile Pigmentation of the Blood Serum, 662.  
Bile Pigmentation of Blood Serum, Surgical Value of the Estimation of, 191, 662.  
Biliary Ducts, Malignant Neoplasms of the Extrahepatic, 205.  
Biliary Surgery, 201.  
BIZARRO, A. H.: Injury of the Limbs Due to Back-fire, 83.  
Bladder Cancer, Drainage in, 801; End Results of Operations for, 352.  
Bladder, Intraperitoneal Rupture of the, 64.  
Blood Coagulation, Effects of Sodium Citrate on, 547.  
Blood Stream, Surgical Significance of Bacteria in the, 421.  
Bone Formation in Operative Wound Cicatrices, 539; Injuries, New Mechanics in 110, Transplantation for Cyst of Tibia, 115.  
Bowel, Small, Resection of the, following Gunshot Injury, 117.  
BRAASCH, WILLIAM F.: Primary Tumors of the Urethra, 246.  
Brachial Artery, Embolism of the, 788; Plexus, Late Suture of, 782; Vessels, Rupture of, Compound Dislocation of Elbow with, 279.  
Branchial Fistula, 648.  
Breast Cancer, End Results of Operations for, 341 and 346; Results of Treatment by Radiation of, 359.  
Breasts, Massive Hypertrophy of, 290.  
Bronchial Fistula, 793.  
Bronchus, Hepatic Abscess Evacuating via, 591.  
BUNTS, FRANK E.: End Results of Operations for Cancer of the Breast, 341.  
BUZBY, B. FRANKLIN: Submaxillary Salivary Calculus, 778.

### C

- CAMPBELL, WILLIS C.: Arthroplasty of the Elbow, 615.  
Cancer, End Results, as Influenced by Type,

# INDEX

- Reaction, Location and Age, 308; Longevity in, 9; of Bladder, Drainage in, 801; of Bladder, End Results of Operations for, 352; of the Breast, End Results of Operations for, 341, 346; Results of Treatment by Radiation of, 359; of the Cervix Uteri, End Results of the Surgical Treatment of, 395; of the Extrahepatic Biliary Ducts, 205; of the Jaws, The Treatment of, 328; of the Neck, End Results of Treatment in, 335; of the Rectum, End Results of Operations for, 386; Involvement of the Lymph-nodes in, 755; Operation for, 795; Treatment of, 500; of Stomach and, Duodenum, End Results of Operations for, 467; of the Thoracic Oesophagus, 333; of the Undescended Testis, 260; Recurrence Versus Metastasis in, 324; Solid, of the Ovary, 768; The Secondary Manifestation of, 312.
- Capitellum and Trochlea, Fractures of the, 78.
- CAYLOR, HAROLD D.: Metaplasia in Ovarian Dermoids and Cystadenomas, 238.
- Cervical Gland Metastasis from Tongue Cancer Treated by Radium, 651.
- Cervical Spine, Fracture Dislocation of, 284.
- Cholecystitis, Chronic Catarrhal, with Lipoid Deposit, 736.
- Cholelithiasis, Intrahepatic, 283, Surgical Treatment of, 201.
- Cicatrices, Bone Formation in Operative Wound, 539.
- Cirroid Aneurism of the Scalp, 524.
- Citrate of Sodium, Intramuscular Administration of, 1.
- Clavicles, Treatment of Fractured, 595.
- Cleft-Palate, 133; and Harelip Deformities, 117.
- Coagulation of the Blood, Effects of Sodium Citrate, 547.
- COFFEY, ROBERT C.: Treatment of Cancer of the Rectum, 500.
- Colitis, Chronic, Appendicostomy for, 792.
- COLLINS, FOSTER K.: Aseptic Resection of Intestine, 739.
- Colon, Adenoma of, 674.
- Colon-Bacillus, Cause of Suppurative Osteomyelitis, 695.
- Colon, Non-rotation of, 281.
- Colostomy for Inoperable Carcinoma Giving Prolonged Relief, 646.
- Concato's Disease, 432.
- CONNORS, JOHN F.: Symptomless Cancer of the Stomach, 674; Traumatic Rupture of the Spleen, 785; Acute Pancreatitis, 786; Embolism of the Brachial Artery, 788.
- Contractures of Hand, Treatment of, 121.
- CORKERY, JOHN R.: Chronic Catarrhal Cholecystitis with Lipoid Deposit, 736.
- Craniotomy for Craniocerebral Defect, 784.
- CRILE, GEORGE W.: End Results of Operations for Gastric and Duodenal Ulcer and Cancer, 467.
- Cyst, Solitary, of Kidney, 656.
- Cystic Kidney, Congenital, 789.
- ## D
- DAVIS, LINCOLN: End Results of the Surgical Treatment of Carcinoma of the Cervix Uteri, 395.
- DAVIS, WARREN B.: Harelip and Cleft-Palate Deformities, 133.
- DEAVER, JOHN B.: Peptic Ulcer, 473.
- Dementia Præcox Syndrome and Thyroid Surgery, 438.
- DeNOVELLES, P. LAWRENCE: Lymphosarcoma of the Intestine, 229.
- Dermoids of the Ovary, Metaplasia in, 238.
- Dilator for Ankylosed Jaw, 647.
- DINEEN, P. A.: Late Results of Gastroenterostomy for Gastric and Duodenal Ulcers, 457.
- Dislocation Backward of Foot on Leg with Fracture of Fibula, 279; Congenital, of the Shoulder, 70; of Elbow, Compound, 279.
- Diverticula of the Duodenum, 43, 125; of Oesophagus, 659.
- DORRANCE, GEORGE M.: Double Lip, 776; Securing Large Skin Grafts, 799.
- DOUGLAS, FRED. M.: Perforation of Duodenal Ulcer Following Gastro-enterostomy, 222.
- DOUGLAS, JOHN: Fracture Dislocation of Cervical Vertebra, 288; Sarcoma of the Small Intestine, 663; Solitary Cyst of Kidney, 656.
- DOWNES, WILLIAM A.: Duodenal Diverticula, 43; Mesenteric Thrombosis, 669; Oesophageal Diverticulum, 661.
- DRENNEN, JENNIE G.: A Bacteriologic Study of the Gall-Bladder Fluid Contents, 482.
- DRENNEN, EARLE: Traumatic Pancreatitis, 488.

## INDEX

Duodenal Ulcer, Perforation of, Following Gastro-enterostomy, 222.

Duodenal Diverticula, 43, 125.

Duodenum and Stomach, Acute Perforations of, 38; Ulcers, Late Results of Gastro-enterostomy for, 457.

### E

EASTMAN, JOSEPH RILUS: Thyroid Surgery and the Dementia Præcox Syndrome, 438.

EASTMAN, NICHOLSON: Thyroid Surgery and the Dementia Præcox Syndrome, 438.

Elbow, Arthroplasty of the, 615; Compound Dislocation of, with Ruptured Brachial Vessels, 279; Fractures, 78.

ELIOT, ELLSWORTH, JR.: Recurrence Versus Metastasis in Carcinoma, 324.

Embolism of the Brachial Artery, 788; Pulmonary, Fat, 581.

Empyema, Chronic, in U. S. Army, 549; Treatment of, 700; with Bronchial Fistula, Operation for, 793.

End Results in Cancer as Influenced by Type, Reaction, Location and Age, 308.

End Results of Operations for Cancer of the Bladder, 352; for Cancer of the Breast, 341 and 346; for Cancer of the Rectum, 386; for Gastric and Duodenal Ulcer and Cancer, 467; of the Surgical Treatment of Carcinoma of the Cervix Uteri, 395.

Epilepsy, Craniotomy for, 784; Cure of, by Extirpation of Adrenal Gland, 176.

Epiphyseal Fractures, Incomplete, at the Hip, 624.

ERDMANN, JOHN F.: Duodenal Diverticula, 125.

Exophthalmic Goitre, 649.

Eyelid, Plastic Operation on, 656.

### F

Face, Plastic Surgery of the, 129; and Lips, Staphylococcus Infections of the, 13.

FARR, CHARLES E.: Intussusception of Appendix, 669; Necrosis of the Pancreas, 787.

Fascia Lata Transplants in Reconstruction of the Oesophagus, 157.

Fascial Flap Operation for Incisional Hernia, 658.

Fat Transplant for Painful Stump, 650.

Femoral Artery, Gunshot Wounds of, 651.

Femur, Immediate Operation for Fracture of the Neck of the, 631; Osteomyelitis of the, 289.

Fibrous Tumors of the Foot, 101.

Fibula, Transplantation of the, 91.

FINNEY, JOHN M. T.: The Opportunities and Responsibilities of the Surgeon, 293.

FISCHER, HERMANN: Extirpation of Adrenal Gland for Cure of Epilepsy, 176; Intussusception of Appendix, 670.

Fistula, Branchial, 648.

Flexor Tendons of Forearm and Hand, Tuberculosis of Sheaths of, 791.

Foot, Backward Luxation of, on Leg with Fracture of Fibula, 279; Fibrous Tumors of the, 101.

Fracture-Dislocation of Cervical Spine, 284.

Fracture of Fibula, with Backward Dislocation of Foot, 279; of the Neck of the Femur, Immediate Operation for, 631.

Fractured Clavicles, Treatment of, 595.

Fractures Associated with Peripheral Nerve Injuries, 528; Compression, of the Lower End of the Radius, 599; Incomplete Epiphyseal, at the Hip, 624; of the Capitellum and Trochlea, 78.

FULTON, WILLIAM J.: Gonococcus in Arm Abscess, 802.

### G

GAGE, HOMER: End Results of Operations for Carcinoma of the Breast, 346.

Gall-Bladder Fluid Contents, A Bacteriologic Study of the, 482.

Gall Stones, Surgical Treatment of, 201.

Gastric Ulcer, Choice of Operation for, in View of Late Results, 476; Factors Influencing the Life Expectancy of Patients Operated on for, 405; Resection of the Body of the Stomach for, 409.

Gastro-enterostomy Followed by Intussusception of the Stoma, 543; Late Results of, for Gastric Ulcers, 457.

Gastro-intestinal Tract, Hæmangiomas of the, 28.

GIBSON, CHARLES L.: Incisional Hernia, 658.

Gluteal Aneurism, Ligation of the Internal Iliac for, 520.

Goitre, Exophthalmic, 649.

Gonococcus in Arm Abscess, 802.

Grafting with Skin, 799.

GRAHAM, EVARTS A.: Surgical Treatment of Syphilis of the Stomach, 449.



## INDEX

GREEN, NATHAN W.: Fracture Dislocation of Cervical Vertebrae, 288.  
Gunshot Wound of Ileum, Multiple, 651; of Femoral Artery, 651.

### H

Hæmangiomas of the Gastro-intestinal Tract, 28.  
HAGGARD, WILLIAM D.: Ligation of the Internal Iliac for Gluteal Aneurism, 520; Cirroid Aneurism of the Scalp, 524;  
HAMANN, C. A.: Faulty Rotation of the Intestine, 491.  
Hand Contractures, Treatment of, 121.  
Harelip, 133; and Cleft Palate Deformities, 117; Double, Treatment of Complete, 143.  
HARTWELL, JOHN A.: Adenoma of Colon, 674; Diffuse Carcinoma of Stomach, 672; Osteomyelitis of the Femur, 289.  
Hepatic Abscess Evacuating via Bronchus, 591.  
Hernia, Incisional, Operation for, 658.  
Herniotomy Followed by Tetanus, 646.  
HIGHSMITH, EMMETT DE WITT: Plastic Surgery of the Face, 129.  
Hip, Incomplete Epiphyseal Fractures of the, 624.  
Hip-joint, Disarticulation of, for Sarcoma, 115.  
HIRSHFELD, SAMUEL: Intramuscular Administration of Sodium Citrate, 1.  
HITZROT, JAMES M.: Myositis Ossificans, 672.  
HODGE, EDWARD B.: Backward Luxation of Leg with Fracture of Fibula, 279; Compound Luxation of Elbow with Rupture of Brachial Vessels, 279.  
HOOKER, RANSOM S.: Chronic Arthritis of Knee-joint, 126.  
HOON, MERLE R.: Solid Carcinoma of the Ovary, 768.  
HORINE, CYRUS F.: Aseptic Resection of Intestine, 745.  
HUNDLEY, JOHN M.: Surgical Treatment of Uterine Prolapse, 106.

### I

Ileum, Multiple Gunshot Wound of, 651.  
Infancy and Childhood, Tumors of the Kidney in, 52.  
Infections of the Face and Lips, 13.  
Internal Iliac Artery, Ligation of, for Gluteal Aneurism, 520.

Intestinal Foci of Infection in Cases of Arthritis Deformans, Surgical Relief of, 515.  
Intestine, Aseptic Resection of, 739, 745.  
Intestine, Faulty Rotation of the, 491; Lymphosarcoma of, 229; Small, Sarcoma of the, 663.  
Intussusception of Stoma Following Gastro-enterostomy, 543.  
Intussusception of the Appendix, 669.  
IVY, ROBERT H.: Actinomycosis, 278; Use of Dilators in Treatment of Jaw Ankylosis, 647.

### J

Jaw Dilator for Mandibular Ankylosis, 647.  
Jaws, Cancer of the, Treatment of, 328.  
JONES, D. F.: End Results of Operations for Carcinoma of the Rectum, 386.  
JONES, WALTER M.: Bone Formation in Operative Wound Cicatrices, 539.  
JUDD, EDWARD STARR: Hæmangiomas of the Gastro-intestinal Tract, 28; Resection of the Body of the Stomach for Ulcer, 409.

### K

Kader Operation, Modification of the, 35.  
KELLER, WILLIAM L.: Chronic Empyema in U. S. Army, 549, 700.  
Kidney, Congenital Cystic, 789; Solitary Cyst of, 656, 658.  
Kidney Tumors in Infancy and Childhood, 52.  
KLOPP, E. J.: Non-rotation of Colon, 281.  
Knee, Chronic Arthritis of, Arthrotomy for, 782.  
Knee-Joint, Chronic Arthritis of, 126.  
Knees, Septic, Willem's Treatment of, 116.

### L

LEE, BURTON, J.: Results of Treatment by Radiation of Primary Inoperable Carcinoma of the Breast, 359.  
LEE, W. ESTELL: Cervical Gland Metastasis from Tongue Cancer, Treated by Radium, 651; Resection of the Small Bowel Following Gunshot Injury, 117.  
Leg, Plastic Operation on, 124.  
LEWIS, DEAN: Peripheral Nerve Injuries Associated with Fractures, 528.  
LEWISOHN, RICHARD: Intrahepatic Chol-

# INDEX

- elithiasis, 283; Intussusception of Stoma Following Gastro-enterostomy, 543; Sarcoma of Rib, 283; Urinary Fistula Following Ureterotomy, 284.
- Life Expectancy of Patients Operated on for Gastric Ulcer, 405.
- LILIENTHAL, HOWARD: Carcinoma of the Thoracic Oesophagus, 333; Treatment of Bronchial Fistula, 794.
- LINDEM, MARTIN C.: Fractures of the Capitellum and Trochlea, 78.
- Lipoid Deposit in Chronic Catarrhal Cholecystitis, 736.
- Lip, Double, 776.
- LIPSHUTZ, BENJAMIN: Branchial Fistula, 648; Malignancy of the Undescended Testis, 260.
- Liver, Intrahepatic Gall Stones, 283.
- Longevity in Cancer, 9.
- LOWER, WILLIAM E.: End Results of Operation for Cancer of the Rectum, 352.
- LUSK, WILLIAM C.: Late Results of Operation for Cancer of the Rectum, 797.
- LYLE, H. H. M.: Formation of a Thumb from the First Metacarpus, 121; Plastic Operation on Eyelid, 656; Skin-Muscle Flap in Case of Osteomyelitis of Tibia, 655; Treatment of Hand Contracture, 121.
- Lymph-nodes, Involvement of, in Carcinoma of the Rectum, 755.
- Lymphosarcoma of the Intestine, 229.
- LYONS, J. H.: Resection of the Body of the Stomach for Ulcer, 409.

## M

- MACAUSLAND W. RUSSELL: Transplantation of Fibula, 91.
- MACCARTY, WILLIAM C.: Longevity in Cancer, 9; Metaplasia in Ovarian Dermoids and Cystadenomas, 238.
- McKITTRICK, L. S.: End Results of Operations for Carcinoma of the Rectum, 386.
- McVAY, JAMES ROBERT: Involvement of the Lymph-nodes in Carcinoma of the Rectum, 755.
- McWILLIAMS, CLARENCE A.: Treatment of Traumatic Synovitis, 677.
- Malignant Disease, Secondary Manifestation of, 312.
- MARTIN, WALTON: Significance of Bacteria in the Blood Stream from a Surgical Standpoint, 421; Staphylococcus Infections of the Face and Lips, 13.
- MASLAND, HARVEY C.: New Mechanics in Bone Injuries, 110.
- MAYO, CHARLES H.: End Results in Cancer as Influenced by Type, Reaction Location and Age, 308.
- MAYO, WILLIAM J.: Peritoneal Manifestations of Chronic Multiple Serositis, 432.
- MELENEY, FRANK L.: A Metastasizing Malignant Tumor of the Thyroid Gland, 684.
- Mesenteric Vein, Acute Obstruction of, 666.
- Metaplasia in Dermoids and Cystadenomas of Ovary, 238.
- MEYER, WILLY: Appendicostomy for Chronic Colitis, 792; Congenital Cystic Kidney, 789; Operation for Cancer of the Rectum, 795; Operation for Empyema with Bronchial Fistula, 793; Tuberculosis of Sheaths of Flexor Tendons, 791.
- MILLER, EDWIN M.: Peripheral Nerve Injuries Associated with Fractures, 528.
- MILLER, MORRIS BOOTH: Willem's Treatment of Septic Knees, 116.
- MIXTER, CHARLES G.: Tumors of the Kidney in Infancy and Childhood, 52.
- MOSCHCOWITZ, A. V.: Treatment of Chronic Empyema, 794.
- MULLER, GEORGE P.: Gunshot Wounds of the Femoral Artery, 651; Tetanus Following Herniotomy, 646; Prolonged Relief from Colostomy for Inoperable Carcinoma of Sigmoid Colon; 646.
- Multiple Gunshot Wound of Ileum, 651.
- Muscle, Rhomboideus Minor, Sprains of, 641.
- Myositis Ossificans, 672.

## N

- Nasal Fossa, Sarcoma of, 662.
- NASSAU, CHARLES F.: Exophthalmic Goitre, 649.
- Neck Cancer, End Results of Treatment in Certain Forms of, 335.
- Nerve Injuries, Peripheral, Associated with Fractures, 528.
- NEUHOF, HAROLD: Arthrotomy for Chronic

# INDEX

Arthritis of Knee, 782; Late Suture of Brachial Plexus, 782; Craniotomy for Epilepsy, 784; Craniotomy for Congenital Craniocerebral Defect, 784; Intramuscular Administration of Sodium Citrate, 1.  
New York Surgical Society, Transactions of the, 121, 283, 655, 666, 782.

## O

O'CONOR SIR JOHN: Hepatic Abscess Evacuating Via Bronchus, 591; Surgical Treatment of Cholelithiasis, 201.  
OCHSNER, ALBERT J.: System of Surgical Diagnosis and Treatment, Review of, 128; The Treatment of Cancer of the Jaws, 328.  
Oesophageal Diverticulum, 659.  
Oesophagus, Thoracic, Cancer of the, 333; Experimental Reconstruction of the, 157.  
OLIVER, JOHN CHADWICK: Congenital Hypertrophic Stenosis of the Pylorus, in the Adult, 444.  
ORR, THOMAS G.: Pressure as a Factor in Skin Grafting, 799.  
Osteomyelitis of Tibia, 655.  
Osteomyelitis of the Femur, 289.  
Osteomyelitis, Suppurative, Due to the Colon Bacillus, 695.  
OTT, WILLIAM O.: Results of Treatment in Sciatica, 272.  
Ovarian Dermoids and Cystadenomas, Metaplasia in, 238.  
Ovary, Solid Carcinoma of the, 768.  
OWEN, HUBLEY, R.: Fat Transplant for Painful Stump, 650.

## P

Pancreatitis, Acute, 786; Traumatic, 488.  
Patella, Bilateral Congenital Absence of, 280.  
PECK, CHARLES H.: Oesophageal Diverticulum, 659; Sarcoma of Nasal Fossa, 662.  
Peptic Ulcer, 473.  
Perforations, Acute, of the Stomach and Duodenum, 38  
PETERSON, EDWARD W.: Duodenal Diverticula, 125.  
Philadelphia Academy of Surgery, Transactions of the, 110, 277, 646, 648.

PILCHER, LEWIS S.: Review of Ochsner's System of Diagnosis and Treatment, 128.  
Plastic Operation on the Hand, 121.  
Plastic Operation on the Leg, 124.  
Plastic Surgery of the Face, 129.  
POOL, EUGENE H.: Late Results of Gastroenterostomy for Gastric Ulcers, 457; Plastic Operation on Leg, 124.  
Presidential Address American Surgical Association, 293.  
PRIMROSE, ALEXANDER: The Secondary Manifestation of Malignant Disease, 312.  
Prolapse of the Rectum in Children, 496.  
Prolapse, Uterine, Surgical Treatment of, 106.  
Pulmonary Fat Embolism, 581.  
Pylorus, Congenital Hypertrophic Stenosis of the, in the Adult, 444.

## R

Radiation of Primary Inoperable Cancer of the Breast, Results of, 359.  
Radium Treatment of Gland Metastasis from Tongue Cancer, 651.  
Radius, Compression Fractures of the Lower End of the, 599.  
RANKIN, FRED. W.: Hæmangiomas of the Gastro-intestinal Tract, 28.  
Rectum, Cancer of, Operation for, 795; End Results of Operations for, 386; The Treatment of, 500; Involvement of the Lymph-nodes, in Carcinoma of, 755; Prolapse of the, in Children, 496.  
RENSHAW, KINSLEY: Malignant Neoplasms of the Extrahepatic Biliary Ducts, 205.  
REFLOGLE, JOSEPH P.: Sprains of Rhomboideus Minor Muscle, 641.  
Resection, Aseptic, of Intestine, 739, 745.  
Rib Sarcoma, 283.  
ROBERTS, JOHN B.: Harelip and Cleft Palate Deformities, 117.

## S

Salivary Calculus, Submaxillary, 778.  
Sarcoma of Rib, 283.  
Sarcoma of the Nasal Fossa, 662; of the Small Intestines, 663.  
SARGENT, ARTHUR F.: Transplantation of Fibula, 91.  
Scalp, Cirroid Aneurism of the, 524.

# INDEX

SCHOLL, ALBERT J. JR.: Primary Tumors of the Urethra, 246.  
 Sciatica, Results of Treatment of, 272.  
 Serositis, Chronic Multiple, 432.  
 SHALLOW, THOMAS A.: Modification of the Kader Operation, 35.  
 Shoulder, Congenital Dislocation of the, 70.  
 SKILLERN, PENN G. JR.: Actinomycosis, 277.  
 Skin Grafting, Pressure as a Factor in, 799.  
 Skin Grafts, Securing Large, 799.  
 Skin-Muscle Flap in Case of Osteomyelitis of Tibia, 655.  
 SMITH, REA: Surgical Relief of Intestinal Foci of Infection in Cases of Arthritis Deformans, 515.  
 SMITH, WILLIAM P.: Eight Toes on one Foot, 546.  
 Sodium Citrate, Effects of, on Blood Coagulation, 547; Intramuscular Administration of, 1.  
 SPELLISSY, JOSEPH M.: Bilateral Congenital Absence of Patella, 280.  
 Spleen, Traumatic Rupture of the, 785.  
 Stenosis, Congenital Hypertrophic, of the Pylorus in the Adult, 444.  
 STETTEN, DEWITT: Acute Obstruction of Superior Mesenteric Vein, 666; Surgical Value of the Estimation of the Bile Pigmentation of Blood Serum, 191.  
 STEVENS, JAMES H.: Compression Fractures of the Lower End of the Radius, 599.  
 STILLMAN, ALFRED: Mesenteric Thrombosis, 669.  
 Stomach and Duodenum, Acute Perforations of, 38; End Results of Operations for Ulcer of, and Cancer, 467; Ulcers, Late Results of Gastro-enterostomy for, 457.  
 Stomach, Diffuse Carcinoma of, 672; Resection of the Body of the, for Ulcer, 409; Surgical Treatment of Syphilis of the, 449.  
 Stomach Ulcer, Choice of Operation for, in View of the Late Results, 476.  
 Stump, Painful, Fat Transplant for, 650.  
 Surgeon, Opportunities and Responsibilities of the, 293.  
 Surgical Diagnosis and Treatment. By

American Authors. Edited by Albert J. Ochsner, Review of, 128.  
 SUTTON, GEORGE E.: Pulmonary Fat Embolism, 581.  
 SYMS, PARKER: Massive Hypertrophy of Breasts, 290.  
 Synovitis, Traumatic, Treatment of, 677.  
 Syphilis of the Stomach, Surgical Treatment of, 449.

## T

TAYLOR, ALFRED S.: Fracture Dislocation of Cervical Spine, 284.  
 Testis, Undescended, Malignancy of the, 260.  
 Tetanus Following Herniotomy, 646.  
 THOREK, MAX: Fibrous Tumors of the Foot, 101.  
 Thumb, Formation of a, from Metacarpus Bone, 121.  
 Thyroid Gland, A Metastasizing Malignant Tumor of the, 684.  
 Thyroid Surgery and the Dementia Præcox Syndrome, 438.  
 TINKER, MARTIN B.: End Results of Treatment in Certain Forms of Malignancy of the Neck, 335.  
 TODD, T. WINGATE: Congenital Dislocation of the Shoulder, 70.  
 Toes, Eight, on One Foot, 546.  
 Transplantation of Bone for Cyst of Tibia, 115.  
 Transplantation of Fibula, 91.  
 Traumatic Synovitis, Treatment of, 677.  
 Tuberculosis of Sheaths of Flexor Tendons, 791.  
 TURNER, T. THOMAS: Intraperitoneal Rupture of the Bladder, 64.

## U

Ulcer, Peptic, 473.  
 Ulcers of Stomach and Duodenum, Late Results of Gastro-enterostomy for, 457.  
 Urethra, Primary Tumors of the, 246  
 Urinary Fistula Following Ureterotomy, 284.  
 Uterine Cancer, End Results of the Surgical Treatment of, 395.  
 Uterine Prolapse, Surgical Treatment of, 106.  
 Uterus Index of the Blood Serum, 662.

## INDEX

### V

VEAU, VICTOR: Treatment of Complete Double Harelip, 143.

### W

WARDLOW, YEATMAN: Eight Toes on One Foot, 546.

WHITMAN, ROYAL: Incomplete Epiphyseal Fractures at the Hip, 676; Incomplete Epiphyseal Fractures of the Hip, 624.

WILENSKY, ABRAHAM O.: Acute Perforations of the Stomach and Duodenum, 38; Immediate Operation for Fracture

of the Neck of the Femur, 631; Rhomboideus Minor Muscle, Sprains of, 641.

Willem's Treatment of Septic Knees, 116.

WINSLOW, NATHAN: Suppurative Osteomyelitis Due to the Colon Bacillus, 695.

WOOLSEY, GEORGE: Choice of Operation for Gastric Ulcer in View of Late Results, 476.

### Y

YOUNG, JAMES K.: Bone Transplantation for Cyst of Tibia, 115; Disarticulation of the Hip-joint for Sarcoma, 115.



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